ELECTRICAL CONSTRUCTION AND MAINTENANCE

JUNE - 1950

49th Year

School Lighting

How to figure the economies of school lighting installations.

Rebuilding

How a motor shop cleared production bottlenecks.

Estimating

How to list, price and extend take-off data.

Special Feature

Wiring Idlewild

The electrical story of New York's great international airport, an Outstanding Electrical Construction feature.

McGRAW-HILL PUBLICATION

Cash in on this Big Floodlighting Promotion Campaign

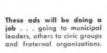


"A Chance to Play" is a twenty minute movie produced by The March of Time for the General Electric Company. It punches home the advantages of floodlighting recreation areas—making recreation available during the hours of darkness. Showings will be notion-wide.

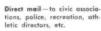
"Recreation Is Everybody's Business" is a deluxe thirtysix page booklet telling community leaders how to plan community recreation centers.



"Industrial Recreation Is Good Business" tells industrial leaders the Why, Where, and How of floodlighted recreation.







Over \$530,000,000 is being spent annually on organized recreation by communities and industries. Now, a tremendous General Electric promotion is telling these groups that recreational floodlighting increases the benefits of their recreation programs. There's a movie produced by The March of Time for the General Electric Company, two valuable manuals, audience literature, all backed by an advertising and direct mail campaign. It's estimated that over 20,000,000 people will see and hear this General Electric promotion. That means a lot of people, industries and communities, are going to want floodlighted recreation fields. And that's where you can pick up some floodlighting contracts.

Here's how to get your share of contracts

First—to know what's going on and the advantages of recreational floodlighting, contact your G-E distributor or sales office and arrange to see or sponsor this program. Then—so you'll have a handy reference for making actual plans and estimates, get General Electric's "Manual of Floodlighting Plans." This manual shows 43 plans—detailed down to lists of material—for all popular outdoor sports. Write for GET-1284C. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



GENERAL



ELECTRIC

451-152

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DIRECT SUNLIGHT

FULLY MAGNETIC Circuit Breakers are NOT Affected by Heat

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By using the magnetic field, which surrounds every current carrying conductor, Murray engineers have perfected a circuit breaker that assures dependable protection combined with freedom from temperature influences. Inverse time delay is effected by a simple, hermetically sealed, factory calibrated hydraulic piston.

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Single pole breakers in 10, 15, 20, 25, 30, 35 and 50 amp. ratings. Only two handle positions — Off and On.

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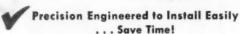
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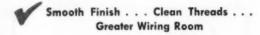
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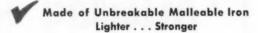
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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

49th Year - JUNE . 1950

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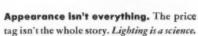
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127
135
141
147
158

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Don't be a
FIXTURE
PICKER!



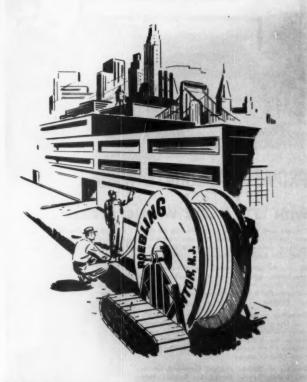
It takes the right equipment, certainly. It also takes expert planning in the application of this equipment to give you the BEST BUY IN LIGHTING. You know that, of course, but how many others do?

Good lighting, combined with practical economics, takes the services of a qualified lighting engineer.

Whether you plan lighting, buy lighting or install lighting, ask for the services of a Westinghouse lighting engineer. J-04283



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5070

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For names of manufacturers and copy of "Questions and Answers About Alcoa E. C. Aluminum", citing records of long service, call your nearby Alcoa Sales Office, or write ALUMINUM COMPANY OF AMERICA, 1785F Gulf Building, Pittsburgh 19, Pennsylvania.

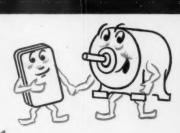


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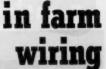
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94 pages of useful sales data



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A COMPLETE SALES TOOL

In addition to the technical pages shown at the left, "Planned Lighting Guide Posts" is packed with selling copy. Between its two covers you have a sales story on every type of lighting, plus facts to back you up!

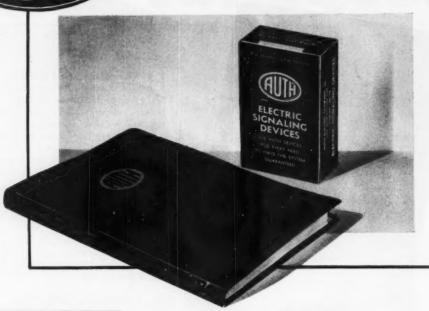
HOW TO GET YOUR COPY

"Planned Lighting Guide Posts" is available through your G-E Lamp District Office at cost—\$1.10 a copy. It's another part of General Electric's extensive lighting program of action to help you sell more Planned Lighting in your area. Call your nearest G-E lamp office today.

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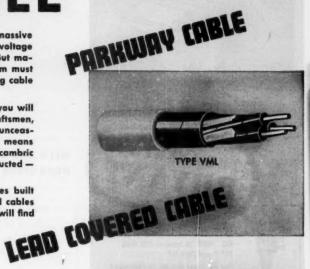
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TYPE RLJFJ

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TYPE V

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Listed as Standard by Underwriters' Laboratories, Inc.

WIRING BEVICES



HE WORD SERVICE has more meanings than there are definitions in a dime store dictionary. It is often used insincerely as a catchword lure ... a pretense as shallow as frost on a window. To others, service is a natural and obligatory complement of selling . . . helping customers select what best fits their needs, filling the order accurately and promptly, and insuring that performance fulfills the promise.

"The meaning of Allis-Chalmers Certified Service is clear and unequivocal. It backs up product performance and assures the buyer that dependable Certified Service is conveniently close.

It is unique, efficient and sound. Unique, because it allies Allis-Chalmers with independently owned and operated shops. Efficient, because it minimizes delay and eliminates heavy transportation expenses. Sound, because the work is performed by reliable and experienced concerns.

"This policy is practiced by all of the 82 A-C Certified Service Shops in every major U. S. industrial area.'

NEW MOTORS AND CONTROLS, TOO

Remember - your nearest A-C Authorized Dealer or Certified Service Shop also offers a complete line of new motors and controls to 200 hp.

ALLIS-CHALMERS, 930A SO. 70 ST. MILWAUKEE, WIS.

A-3079

hes Copper Electric Co., Inc.

CALIFORNIA
San Diogo—Calif. Elect. Works
Les Angeles—Larsen-Hogue Ele
Gatians — L. Rosenberg Comp

— Weidenthal-Go

Benver-Baker Electric Commany CONNECTICUT

Stanley J. Leen Company

MARYLAND Bultimore—Keystone Elec. Co., Inc.

MASSACHUSETTS

MINNESOTA

MISSISSIPPI

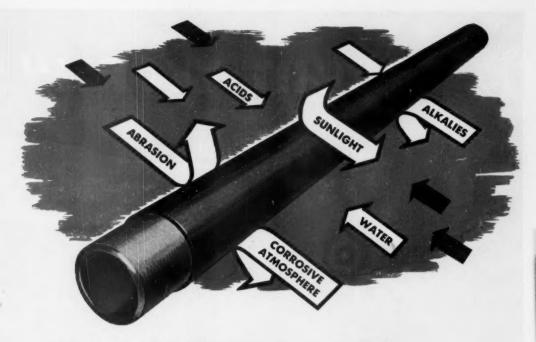
W MEXICO

THERE ARE O'L

ALLIS-CHALMERS



Fastest-Growing Manufacturer in the Field



Cut Costly Corrosion with Polyethylene-Coated Conduits!



THOUSANDS OF MILES OF electrical conduits coated with BAKELITE Polyethylene

Plastic are now banishing corrosion problems in industrial and commercial "hot spots."

Typical of these are chemical, meat-packing and sewage-disposal plants, dairies, farms, mines—many another location where wet or corrosive atmospheres and chemicals make other coatings fail rapidly.

In addition to resisting attack by oils, greases, water, most strong chemicals, a BAKELITE Polyethylene coating on conduits—or insulation on wire and cable—possesses a low dielectric constant and power factor. It is impact- and abrasion-resistant. It has an extremely low rate of water absorption. Inherently flexible and extensible

over a very wide temperature range, it is highly resistant to weather.

Engineers, designers, builders, will do well to investigate conduit coated with BAKELITE Polyethylene—to secure longer service, at lower cost and reduced maintenance, and to reduce power failure worries to the vanishing point. For information on suppliers of conduit, wire, and cable coated with BAKELITE Polyethylene, write Dept. IO-41.

Data on Dekoron Electrical Conduit courtesy Samuel Moore & Co., Mantua, Ohio



'NIGHT WORK"

made

ON THE FARM

easier with ACSR

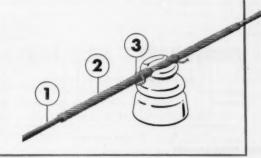
U·S·S American ACSR Cable helps take the backache out of farm work. Thousands of miles of ACSR (Aluminum Cable—Steel Reinforced) have already been installed, bringing city conveniences and comforts to rural areas. Utilities and rural electric cooperatives can put up still more miles of line with minimum cost for cable when ACSR is used.

U·S·S American ACSR Cable is economical to install and economical to maintain. The extra high tensile strength of the steel-reinforced cable permits the use of long spans, and, consequently, fewer poles and accessories are required. And high con-

ductivity and outstanding resistance to corrosion are assured with this durable aluminum cable. Long-lasting ACSR Cable produces a line that is highly resistant to wind, sleet and ice loads.

To assure the utmost in uninterrupted service, guard your ACSR Cable with P.F.T. Preformed Aluminum Armor Rods. They dampen vibration, protect the conductor from burning, chafing, pitting and installation damage. The use of Multiple Wire Ties further safeguards against line trouble. These high-strength galvanized ties are noted for long service life.

- 1. U·S·S American ACSR Cable is an aluminum conductor reinforced with high-strength steel for greater strength and longer line life.
- P.F.T. Preformed Aluminum Armor Rods protect conductors against vibration, chafing, arcover, pitting and corrosion... maintain equal agas. They're easily installed.
- 3. Multiple Wire Ties hold armored conductor securely to insulators . . . help to eliminate abrasion . . . guard against trouble at the supports, one of the most vulnerable points.



AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OH, COLUMBIA STEEL COMPANY, SAM FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



AMERICAN ACSR CABLE

UNITED STATES STEEL

Peerless Electric direct-drive utility blowers



Peerless Utility Blowers are known the country over for dependability. They are widely used for general ventilation and exhaust where duct systems are required, and for wash rooms, boiler rooms, restaurants, or wherever circulation through a limited area is indicated. Compact, easy to mount and quiet in operation, these blowers are designed to deliver large volumes of air at extremely economical cost.

HOUSING AND WHEELS - The arc-welded housings are constructed of 16-gauge steel, with sturdy spot-welded motor bases. Wheels are designed for efficient operation and are dynamically balanced. Heavy cast-iron hubs support the rigid riveted wheels.

MOTORS - Available in all types of current characteristics, to suit all requirements. Single-phase motors are wool-packed, sleeve-bearing, resilient-mounted for quiet operation. Three-phase units, either sleeve or ball bearing, are rigid mounted. Units with single-phase motors are shipped from stock as follows:

Size 0-Permanent split-capacitor type, 115 volt Sizes 1 and 114-Split-phase type, 115/230 volt

Sizes 11/2, 13/4 and 2-Capacitor-Induction type, 115/230 volt

ROTATION AND DISCHARGE—The units are constructed as standard in clockwise rotation but can also be furnished counter-clockwise when so specified. Housings may be turned in any one of eight different ways at time of installation, for any discharge direction desired.

FINISH - The finish is hard baked gray enamel for durability.

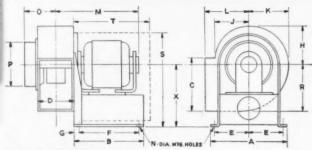
CUSTOM FEATURES—Weather-proof covers, available for outside installation, eliminate the need for penthouse or other protection. Inquiries are invited for other special features that may be desired, such as brass wheels, isolation dampeners, or special designs to fit particular applications. Numerous units are being built today for such special requirements.

CAPACITIES-These blowers are tested and rated in accordance with test codes adopted by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

GUARANTEE - Complete units are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Every unit shipped is recorded in the name of the purchaser as to all of its features (size, motor, windings, etc.) to benefit you greatly for immediate identification for spare parts, replacement or duplicate requirements.

BLOWER PERFORMANCE DATA

No.	Motor H.P.	Blower RPM	Free Air	1/4"	1/4"	36"	16"	%"	3/4"	1"	11/4"	Shipping Weight	
0	1/20	1725	184	169	144	112		****	****	****	****	20	
1	1/20	1150	390	330	250	100						45	
1	1/6	1750	595	580	515	470	420	365	300	****		55	
11/4	36	1150	635	580	480	395	290					50	
334	36	1750	965	920	870	815	765	710	855	540	380	57	
11/2	14	850	785	700	625	515	****	****	****	****	****	100	
31/2	3/4	1150	1125	1005	1005	800	830	740	810			92	
13/4	1/2	850	1590	1545	1485	1450	1420	1300	1340		****	130	
11/4	3/4	1150	2085	1955	1890	1815	1795	1685	1500	1275		142	
2	1/2	690	****	2170	1888	1435	1190		****			200	
2	3/4	850	****	2485	239)	2215	2005	1820	1630			220	
2	2	1140		3620	3444	3275	3080	2825	2800	2385	2280	244	



BLOWER DIMENSIONS

Wodel No.	Wheel	Bore	A	B	C	D	E	F	G	Н		L	K	N	M	0	P	R	X	8	T
0	4½ x 2½	36	71/6	836	836	394	396	455	34	31/2	334	414	394	75a	896	294	43/5	456	5%	9	10
1	8 x 3	96	994	8	7%	414	454	7	36	41/2	4	5	5	36	1136	396	8	716	916	13	12
134	734 x 374	56	1876	8	834	516	5	7	36	834	496	634	5%	36	1194	4	716	8	916	13%	12
136	9 x 4%	96	1216	11	1014	816	894	10	36	8%	596	7%	7%	36	1416	436	9	914	10%	1856	14
134	10% x 854	34	14%	1134	1136	716	876	10	34	7%	8)4	894	9	96	1896	47%	11	10%	111/4	17%	18
2	12½ x 8		1514		13	1814	836			936	834	1134	976	36		7	1234	1294	1434	221/4	20

Certified Dimension Prints Furnished on Request.

* Depends upon Motor used.

THE Peerless Electric COMPANY . WARREN, OHIO



Eliminate Cable Waste

... with NEUTRAL BAR EXTENSIONS

You're cutting your profits when you pull extra footage of main feeders to reach the neutral bar... footage that usually ends up as scrap when final connections are made.

Eliminate this cable waste by using Westinghouse Nofuze Convertible Distribution Panelboards. A built-in neutral bar extension makes it possible to locate all feeder terminal connections (including neutral) at the same end of the panel.

This is but one example of many cost-saving features found in Westinghouse panelboards. Combined with timesaving features and topquality construction, Westinghouse gives you a superior panelboard that costs less... when all the bills are in. Next time, be sure about savings. Specify Westinghouse!

Descriptive bulletin 30-930 contains complete information. Call your nearest Westinghouse office or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-93455-A





Pullout Combinations

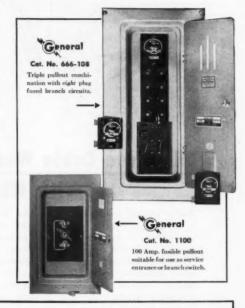
Here is the latest product of constal engineering another new triple pullout combination specially designed to save the contractor time and trouble on installations requiring both a main and range combination and an additional switch for clothes dryer, water heater, pump or any other 220V, 30 or 60 Amp. circuit.

Available with either series or parallel connection, the new units are adaptable to many wiring requirements—special internal construction permits individual wiring of the lower pullout switch where separate metering is required—the series unit may be energized through its subfeed lugs from Connected 100 Amp. fusible main pullout switch, thereby making the three pullouts available as individual branch switches. The parallel connected unit has 100 Amp. main lugs.

The next time ask for the new Main and Range "Plus" and learn why "The Switch is to General".

Write for latest Catalog 4809 and Supplement 4911.

Sold exclusively through wholesalers.





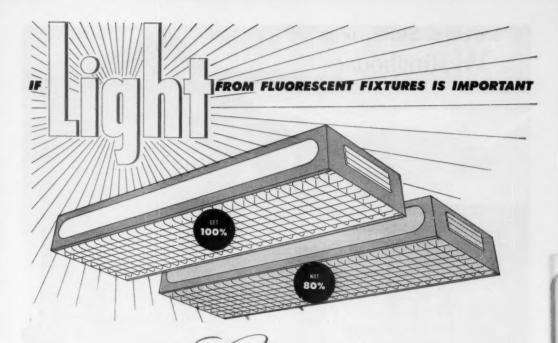
One of the leading Manufacturers of: SERVICE EQUIPMENT . . .

Pullout, Front Operated Toggle and Side Operated types. Indoor—surface or flush, and Outdoor.

SAFETY SWITCHES...

30 through 1200 Amp., 250 V and 600 V Type A, C and D. Indoor and outdoor. HP rated.

ELECTRICAL DISTRIBUTION EQUIPMENT SALES OFFICES IN EVERY MAJOR CITY



specify...

ERTIFIED BALLASTS

CERTIFIED BALLASTS assure rated light output from fluorescent tubes . . . you get the light you pay for!

Some uncertified ballasts reduce light output by as much as 20%, even though it is not noticable to the eye.

Thus, an installation of 8 fixtures using CERTIFIED BALLASTS would give the same amount of light as 10 fixtures with poor ballasts.

Be sure . . . be economical . . . specify CERTIFIED BALLASTS.

CERTIFIED BALLASTS are made to exacting specifications, then tested and checked by Electrical Testing Laboratories, Inc., an impartial authority, which certifies the ballasts conform to the specifications. Up to the minute information on the types of CERTIFIED BALLASTS available from each participating manufacturer may be obtained from Electrical Testing Laboratories, Inc., 79th St. and East End Ave., New York, N. Y.



ERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO



Rice Hotel REMODELS and SAVES with Low Impedance Bus Duct

While the basic advantage of using bus duct is to secure more adequate secondary power distribution, the choice of bus duct should not stop there.

Take the case of the installation limitations at the Rice Hotel, Houston. The problem: to completely remodel and air condition from basement to penthouse—and without interruption of "business as usual".

The answer: Westinghouse Low Impedance Bus Duct. Its compact design and freedom from protruding members permitted passage in places where dimensions were critical. Limited space, because of pipe and air duct systems, ruled out ordinary wiring, as well as other makes of bus duct.

Ask your nearby Westinghouse representative to tell you all the advantages of Westinghouse Bus Duct, available in four popular types. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.





-you'll find what you need in the Complete line

These pictures will give you an idea of the wide variety offered in the Penn-Union Caralog:

Grounding connectors, clamps, and studs for all combinations of pipe, rod, flat bar, braid, tubing.

Every one a thoroughly tested, dependable unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.

Penn-Union also makes the complete line of Service Connectors, Power Connectors, Tees and Cable Taps, Straight and Parallel Connectors and Reducers, Terminal Lugs, etc.

Penn-Union fittings are the first choice of leading utilities, industrial corporations, electrical manufacturers and contractors—because of their known dependability.

Sold by Leading Wholesalers



PENN-UNION ELECTRIC CORPORATION

Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto



THE Complete LINE OF CONDUCTOR FITTINGS









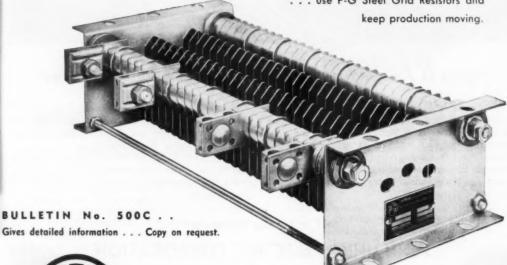
Resistor failures cost money

LOST MACHINE TIME... DAMAGE TO MOTORS... DAMAGE TO CONTROLS... COST OF NEW RESISTORS...

P-G Steel Grid Resistors REDUCE THIS COST ...

Steel and mica construction with provision for expansion, enable P-G Resistors to withstand many factors frequently causing resistor failure. By fewer failures, P-G Resistors minimize the effect of lost machine time and expensive electrical maintenance. Be protected

. . . use P-G Steel Grid Resistors and





THE POST-GLOVER ELECTRIC COMPANY

221 WEST THIRD STREET, CINCINNATI 2, OHIO

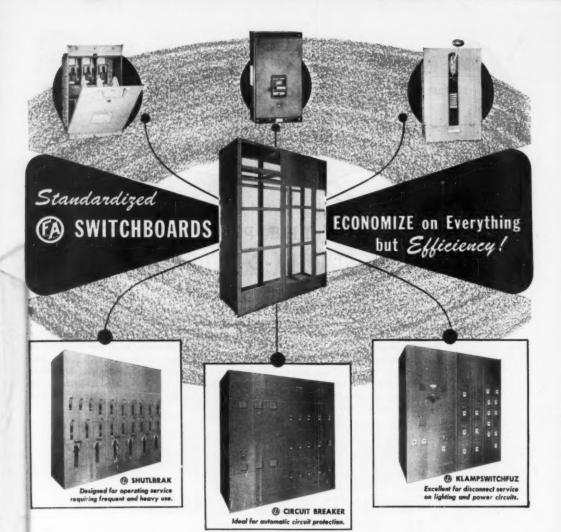


When planning transmission and distribution systems for installation in conduit, in underground ducts, or in open air raceways in buildings, you'll take a big step toward low-cost operation by specifying Simplex-Anhydroprene Cables. . . . Their simple construction, stable electrical and physical properties, and versatility provide many advantages profitably realized in low purchase cost, low installation and maintenance costs and long service life. . . . Some of these cost-cutters are included in the checklist below. But even they are only a few of many available to you when you install Anhydroprene Cables. For the complete Anhydroprene story, plus specification data, drop us a card today for Bulletin 115. (Fill out and mail the coupon below.)

- Light Weight
- Small Diameter
- No Braids to Rot
- Flexibility at Low Temperatures
- Abrasion Resistance
- Low Water Absorption
- Protection against Oils, Heat, Sunlight and Flame
- Resistance to Acids, Alkalies and Corrosive Chemicals
- Easy Jointing and Tapping
- Elimination of Duct Lubricants
- No Potheads Needed at Terminations

Simplex-Anhydroprene Cables are recommended for plant and shop wiring, for instrument wiring, for use as underground primaries and secondaries, transformer leads and pole line risers, and in signal and control circuits.





THE STANDARDIZED DESIGN OF SWITCHBOARDS, introduced to industry by the Frank Adam Electric Company many years ago, is still one of the great "firsts" among electrical manufacturers.

Today, all ® Switchboards... ® Shutlbrak, ® Klampswitchfuz and ® Circuit Breaker... are built to your specifications from standard, preassembled units. This flexible plan of standardization permits final assemblies to be "made to order" without destroying the savings and advantages of standardized equipment.

Also... "at no extra cost"... many other features of economy and efficiency are incorporated into ® Switchboards. They, too, are standard engineering features resulting from more than 58 years of electrical manufacturing experience... making ® Switchboards the finest in safety, service, performance and appearance.

Ask your (§ Representative (he's listed in Sweet's) to point out how standardized (§ Switchboards can economize on everything but efficiency in your electrical system.



Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT . PANELBOARDS . SWITCHBOARDS . SERVICE EQUIPMENT . SAFETY SWITCHES . LOAD CENTERS . QUIKHETER

YOU CAN'T BEAT A

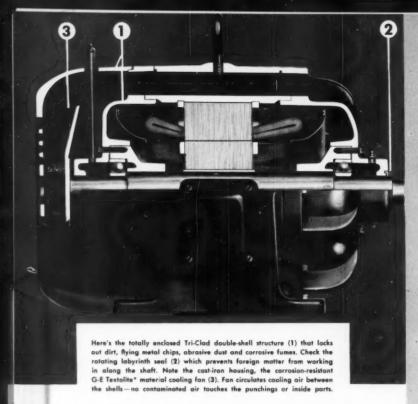
TRI CLAD MOTOR FOR

CORROSION RESISTANCE



GENERAL & ELECTRIC

Here'



You can't beat TRI CLAD motors

for corrosion resistance

Acid fumes, alkali dust, dye-house vapors, tropical weather — you name *your* motor "poison." You just can't beat Tri-Clad cast-iron construction for corrosion resistance.

Rolling up 6 billion hours of service on all kinds of jobs, more than 1,876,000 Tri-Clad motors tell the eye-opening story of cast-iron motor structure. You get an inherent damping action that minimizes noise and damaging vibration. You get rigidity that makes for permanent shaft alignment. (Try bolting a Tri-Clad motor to an uneven surface—the bolt will snap before you can twist the rigid frame out of line.) You get extra protection against jarring blows and rough handling. You get resistance to rust and corrosion that is not approached by any other metal used for standard motor construction today.

WANT MOTORS THAT STAY ON THE JOB ANWYHERE? There's a stock of Tri-Clad motors near you, in nearly all types and ratings, ready for IMMEDIATE SHIPMENT. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

*Reg. U. S. Pat. Off. (standard on popular sizes)

GENERAL 🎉 ELECTRIC

TRI CLAD EXTRA PROTECTION



O-E capacitor meters for use on fami blowers, pumps and compressers will single-phase power. From 36 to 5 he



G-E Type ACA Induction motors for adjustable speeds—provide speed ranges from 3-1 to 20-1. From 3 to 75 hp.



G-E open (dripproof) induction motors for constant-load, constantspeed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corresive fumes. From 1 to 1000 hp.



Look for this EXTRA on the motor you buy!

FLUORESCENT GOES FLEXIBLE!

Now! For the First Time — Circles! Curves! Any Angle!

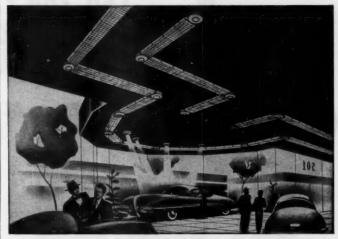
Sensationally new in concept, qualitybuilt in the Day-Brite tradition, PLEXOLINE is making headline news. Since its recent debut, lighting experts have discovered and praised Plexoline's unprecedented ability to achieve unlimited custom-lighting effects without premium cost.



SIMPLE, PRACTICAL PRINCIPLE

Three basic elements form the PLEX-OLINE system: 1. Linear section; 2. Circular accent unit; 3. Adapter fitting. The two illustrations show how the elements are used in combination to form any lighting pattern desired. All elements are complete in themselves, may be used individually.





PLEXOLINE AND IMAGINATION-AN UNBEATABLE SELLING COMBINATION!

Never before such wonderful possibilities for store and showroom lighting! Dramatic, beautiful PLEXOLINE creations put light where you want it . . . how you want it! Straight linear sections for offices, schools, colleges, banks, public buildings.

Plexoline

THE ONLY LIGHTING SYSTEM WITH TRULY UNLIMITED "FLEX-ABILITY"

What does PLEXOLINE mean to you? It means new freedom for your imagination. It means a line of light following a gently curving wall contour... angular patterns of light ... circles... any design. It means—for the first time in history—all the advantages of custom-lighting with

all the economies of a mass-produced system of fixtures.

Today, send for the whole amazing story of PLEXOLINE. Fill out and mail the coupon below. See for yourself what PLEXOLINE's unique "flex-ability" can do for you!

THE PLEXOLINE SYSTEM

LINEAR SECTIONS—For Slimline and standord Fluerescent, 2- and 4-light, 4', 6', and 8' lengths, surface or suspension mounted. Albalite glass side punels, interlocked steel louvers, finished in HOT-BONDED SUPER WHITE enomel. CIRCULAR ACCENT UNITS—15" and 21" diameter, with fixed Centrolons® or adjustable spot mechanism. Luminous sides. Surface mounted only.

ADAPTERS — Uniform, die-formed, allsteel—in two sizes to fit circular units.





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Please "PLEXO								
Name.						 		
Address						 		
City					21-			

You can't buy Better Fittings

MA CONTRACTOR OF THE PARTY OF T

or ones that cost less to use



Showing

Quicker to use and neater in appearance, Briegel All-Steel Indenter Fittings not only make stronger connections but also make each job more profitable to the contractor and satisfactory to his customers.

Two Easy Squeezes and they're set to stay. It is only natural that the Briegel All-Steel Indenter Fittings are the most widely used E.M.T. connectors and couplings. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job neater, stronger and better.



All B-M Fittings Carry the Underwriters Seal of Approval



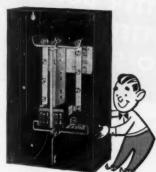
BRIEGEL METHOD TOOL CO.

DISTRIBUTED BY

The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Enameled Metals, Pittsburgh, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

4. simple steps for immediate local delivery on any Pushmatic Electri-Center

Here's how it's done: Distributor gives you the basic Electri-Center box and







PUSH-It's ON!

PUSH-It's OFF!

PUSH-It's ON again!

Push-button switch with automatic protection for electric circuits.

THERE'S a Pushmatic to meet every load condition: THERMAL ONLY, THERMAL-MAGNETIC, and THERMAL-MAGNETIC with exclusive AMBIENT COMPENSATING FEATURES. All are identical in size and contour, in ratings of 15, 20, 30, 40 and 50 amperes, 1 pole, 120 V., or 2 poles, 120-240 V., AC. All are interchangeable for rating and type.

Your local BullDog Distributor is ready to give you immediate delivery on any Pushmatic Electri-Center. See him soon.

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO



HEADQUARTERS FOR ELECTRICAL DISTRIBUTION



shelves for . . .



Pushmatic's amazing flexibility gives you immediate delivery when time counts. Every order filled to meet your specifications!



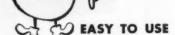
That's what Guy W. Probst, owner of the Lockhaven Electric Repair Co., Lockhaven, Pa., says about General Electric's 9574. Here is his statement:

"G-E all-purpose insulating varnish 9574 gives you a cover coat you can see and that fills up between the Formex wires. I've had very good success with it on armatures up to 2000 RPM. On formed coils I can bake before forming and the turns don't come apart when you pull the coil. I've had no trouble with sludging, and all my work is hot dipped. I find that I only use about half as much 1201 Glyptal as a cover coat on 9574 as I had to use over the varnish I had been using, and I get higher gloss and better bonding when 1201 is used over 9574."

*G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G.E.'s complete line of electrical insulating materials, including adhesives, wedges, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, varnishes.

You can put your confidence in

GENERAL E ELECTRIC



bakes at LOWER TEMPERATURES than is possible with most other synthetic varnishes.

PENETRATES EASILY into the deepest

NO SPECIAL THINNER required (just petroleum spirits).

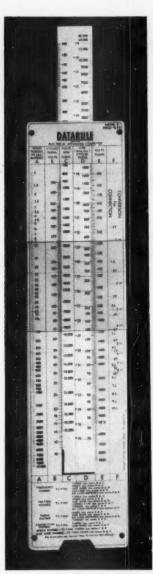
STABLE—will not tend to harden in the tank.



SEND FOR

If you haven't yet tried G-E
9574, get in touch with your local
G-E Distributor, or write for our new
bulletin to Section K-2, Chemical Department,
General Flectric Company, Pittsfield, Mass.





The Only Complete

ELECTRICAL APPARATUS COMPUTER IN EXISTENCE!

FOR COILS AND WINDINGS



WILL SOLVE ALL YOUR "TOUGH NUT" PROBLEMS From a 1/500th H.P. Micromotor To a 10,000 H.P. Motor

From a micro-amp choke coil To a 100,000 KVA Transformer

In making a FREQUENCY CHANGE

In making a VOLTAGE CHANGE

In making a TURNS CHANGE

In making a CONNECTION CHANGE

In making a SPEED CHANGE

In making a SIZE OF WIRE CHANGE

The DATARULE will determine the number of TURNS resultered; the resistance in OHMS resulting; the SIZE OF WIRE needed; what VOLTAGE can be applied at the new frequency; the new IDLE AMPERAGE

the DATARULE will determine the number of TURNS required; the resistance in OHMS resulting; the SIZE OF WIRE needed; the proper CONNECTION DATE; the change in TORQUE; the new IDLE AMPERAGE; what SIZE CAPACITOR to use.

the DATARULE will determine the AMPERAGE; the resistance in OHMS resulting; the SIZE OF WIRE needed; the new IDLE AMPERAGE; the change in TOROUE.

the DATARULE will determine the number of TURNS required; the SIZE OF WIRE needed.

the DATARULE will determine the number of TURNS

the DATARULE will determine the resistance in OHMS

THE INSTRUMENT YOU HAVE BEEN WAITING FOR!

- Elimates Memorizing Formulae
- Eliminates Costly Errors Provides Speedy Redesign Specifications Eliminates Textbook Research
- Instantaneous Answers to Problems
- Eliminates Complex Computation Precision to an Ampere Turn Eliminates Use of Higher Mathematics

New York 13, N.Y.

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The Datarule is intended to make the redesigning and checking of electrical equipment practically foolproof and simple. It is intended to assist the engineer in checking design, the shop man in solving his everyday problems, and the student in coordinating and extending his technical education.

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ANACONDA WIRE AND CABLE



Isn't this a pretty kettle of fish?

SURVEYS reveal an appalling misunderstanding among young people of the 'facts of business life." For example, a poll was made among seniors in certain high schools which showed that they believe business profits are "over 50%" of the sales dollar, where actually profits average less than 8%. These students also think that stockholders receive 24% of the sales dollar, where actually it runs less than 3%. Isn't this a pretty kettle of fish?

A greater part of the 8% of the sales dollar is reinvested in the business to expand and improve plant facilities which protects employ-

ment and creates new jobs for more workers.

Such ignorance is alarming. It is unfair to the young people themselves and dangerous to America's furture. Such misconceptions open the door to socialism, communism and all the fantasies of the handout or "something-for-nothing" state of the economic dreamers.

Our school teachers say they want authentic information on the business system and how it works. Only business itself can supply the facts. You as a business leader in your community must share the responsibility for this misunderstanding. It is our civic duty to help overcome this misconception of everyday economics in the minds of our youth today.



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JUNE . . . at a Glance

Electrical Modernization

Next month we are presenting a comprehensive 36-page editorial feature section devoted to the vitally important field of electrical modernization. Market surveys are indicating that there is a rapdly growing volume of electrcal work in existing plants, offices, stores and institutions in prospect. We have endeavored to give, in practical drawings and photos, directly useful data and methods for meeting the problems usually encountered in this type of work. The section will also include valuable estimating data pertinent to electrical modernization. Watch for this feature in your July issue.

Idlewild

New York's International Airport at Idlewild is designed to take the heavy loads of inter-continental aircraft. It is equipped with the most modern landing aids, both lighting and electronic. In spite of its great size and complexity, however, Idlewild offers a practical study for everyone interested in electrical work on airports. Many of the devices installed and methods used are equally applicable to smaller airport installations.

Author Bob Blatt is extraordinarily well qualified to do this story. As Chief Airport Lighting Engineer for the Civil Aeronautics Administration several years ago, he was in on the development work on lighting now appearing on our airports. He holds an active commercial pilot's license and flies his own plane. He is now Associate Editor of Electral World.

Shop Bottleneck

Those spots where work piles up or slows down can persist through the years for want of shutdown time to clear them up. At Elliot Electric Co. in Cleveland, there were several. Shutdown time was enforced by a bad fire and rebuilding opened the way to clearing out the old bottlenecks in shop production.

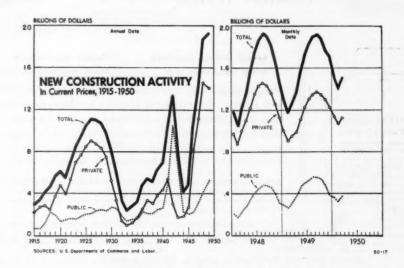
Hugh Scott's article, "Rebuilding Clears Bottlenecks", on page 58 tells the story. Several of the ingenious shop methods developed are illustrated.

Figuring Feeders

Four places where errors can creep into the estimate are discussed in this month's article in the series, "How to Estimate Electrical Work" on page 56. How to transfer take-off to pricing sheets. How to list items on pricing sheets, How to price individual items, How to extend and total quantities.

School Lighting

The economics of school lighting is an important consideration for everyone concerned. One of the most thorough studies to come to our attention in recent years is the work of John J. Neidhart, Lighting Engineer with Westinghouse at Cleveland. In "School Lighting Economics", page 62, Mr. Neidhart presents a comprehensive cost comparison and analysis covering 23 different lighting systems commonly used.



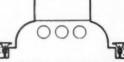
For Beautiful Simplicity -with "beautiful" installation economy!



Caally Slimline-Troffer

NHT-200

in various one-piece lengths up to 8 ft.



ACOUSTICAL-CEILING INSTALLATION

(else equelly "Gest" fibrings for other types of callings)
Yes = EASY - QUICK - to install . . . The Leader Slimline Troffer has a specially designed flonge that snaps easily into ceiling T-bar construction . . Clickl and the Leader Slimline Troffer is in place! . . Moreover, the length of this unit means fewer fixtures to install.

From any angle, in-

stallation costs are few and small. beauty through simplicity

lower installation cost

flexible light volume

lower maintenance cost

Here is a long, symmetrical fixture that "cooperates" enthusiastically with architects and contractors who want to achieve the present-ultimate in lighting beauty and economy. Recessed lighting in extra-long fixtures with a shielding-choice of louvers, baffles, glass enclosures and various special type lenses. Extra length means fewer lamps . . . reduced maintenance cost. Ask us for full details!

SPECIFICATIONS: The LEADER SLIMLINE-TROFFER is wired for 1, 2 or 3 slimline tubes, in 42" to 96" length. Housing and channel of 18 gauge steel. Exterior and end cap finished in rich silver-gray enamel, with high-reflecting white chip-proof baked enamel interior. Extra-stardy one-piece construction. Instant-start 100, 200, 300 or 425 milliampere operation.

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Better Than Bidding

VIRTUALLY ANY METHOD of contact negotiation is better than bidding. The complexity of modern construction work, particularly in the mechanical trades cannot tolerate the opposition of owner and contractor interests which is inherent in the lump sum contract. Nor can the electrical industry long support the useless waste of valuable time and effort to produce long lists of competitive bids.

CURRENT COMPETITION and bidding lists are causing some contractors to take a critical look at bidding practice. It costs, after all, just as much to figure the lost work as it does to estimate the successful bid. And when the ratio of successful bids to work figured drops, costs mount.

NOT MUCH CAN BE DONE to cut estimating time. An estimator or several estimators can figure only so much work. If more plans have to be figured to keep up the desired volume, more estimators have to be employed. Provided, that is, the company is willing to devote its entire sales effort to bidding low against the field.

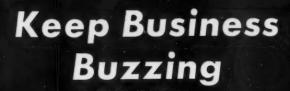
TIMES LIKE THESE show up price bidding in ugly perspective. In volume, current contract awards are way ahead of any previous period in history. But by the time bids are in and the generals have shopped the subs, the job is likely to be squeezed dry of any prospect of adequate operating margin. Too often the price is set by the lowest irresponsible bidder.

JOINT EFFECTS of rocketing estimating costs per dollar of successful contract and declining margins obtainable on competitive work can make price bidding uneconomical. We find our industry in the curious position of spending ever larger sums of money to depress our own margins.

COMPETITIVE BIDDING is usually considered a cheap substitute for effective selling. But is it? Actually, it is grossly expensive and in too many instances incapable of producing a profitable sale. It is not surprising that many construction industry people are convinced that competitive bidding is wholly evil in its economic effects and must be replaced by other methods of contracting.

NEGOTIATED UPSET PRICE and cost plus percentage or fee offer one of the most effective methods. The much maligned cost plus is still the fairest and most economical method of contracting with firms of known responsibility and integrity. Other means may evolve. But every contractor ought to be working for the elimination of competitive bidding. It is out of harmony with modern construction responsibilities. Something better than bidding is needed to negotiate today's enormous and ever changing construction operations.

William Y. Stuart



with signaling via Graybar

Show your customer how, with a flick of a lever, he can "buzz" or talk to anyone, anywhere in his plant. Point out that clear, fast communication among various departments saves many hours of time ordinarily lost in locating personnel, issuing urgent orders and checking operations. Then remember that Graybar has all the voice or code-paging equipment you need to fill your contract quickly and efficiently.

From "intercom" to siren

There's Webster Electric Teletalk, an amplified communication system that connects him directly with personnel at selected points in his plant. It relieves switchboard congestion and saves countless steps through two-way or multiple inter-office conversations. There's the Edwards Lokator, a paging system that speeds location of personnel throughout the plant. Installations can be made with a wide variety of signals – from buzzers, musical notes or silent flashing lights to bells, horns, or howlers that will penetrate any plant noise. Or he may like UIS Sound-powered Telephones. For common or selective talking systems, these handsets transmit distortion-free conversations over long circuits without external power! A rugged weatherproof set is available with magneto howler signals. For warning, Graybar has Benjamin and Federal sirens. The coupon below will bring you details.

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WIRING IDLEWILD

How the electrical installation at the New York International Airport at Idlewild was designed and installed—including high intensity lights on all runways, both the latest slope line and condenser discharge high intensity approach lights, taxiway lights and all of the most advanced lighting and electronic landing aids. Many of the installation details described here also apply to the smaller airport lighting installations.

By Robert C. Blatt

DLEWILD has been planned and designed to handle the air traffic for the world's most important air terminal—the City of New York. Nine times larger than La Guardia Airport, the New York International Airport at Idlewild has approximately 4900 acres or 7.1 square miles, equivalent in area to all of Manhattan Island from the battery to 42nd Street.

The runways range in length from 6000 to 9500 ft and can be increased to between 12,000 and 15,000 ft if required by jet transports of the future.

The above air view shows six runways completed and grading work in progress for the new instrument runway "V". Approximately two million lineal feet of electric conduit (1½ in. to 5 in.) has been installed to date with over 1,400,000 ft of underground cable.

More than \$90,000,000 has been spent so far with electrical installation to date exceeding \$8,000,000—approximately 15 electrical contracts over \$100,000—three of them over \$1,000,000 and one almost \$2,000,000.

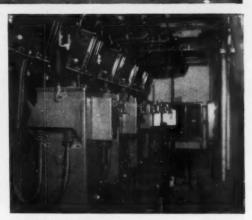
Under the original planning it was estimated that the completed airport would have a demand in excess of 15,000-kw, for the runways, taxiways, service roads, administration, loading, utility bldgs., and passenger buildings, hangars, etc.

During the next several years The Port of New York Authority will replace the present temporary building structures at the airport with a fine permanent terminal building. Other structures will be added in the vast 160-acre central terminal area—shops, restaurants, office building, and other modern buildings, including possibly a hotel, theatre, sports arena, and exhibition hall.

Outstanding Electrical Construction...



CONCRETE ENCASED ducts protect all underground cables. Most airports have directly buried cable. 10 way- 5 in. duct bank shown. Precast concrete duct separators provide neat and uniform spacing of fibre ducts.



SWITCHGEAR EQUIPMENT in transformer voult of temporary administration building showing 4-kv primary bus (top center) with air disconnecting switches (top left) and remote control oil circuit breakers (left center and bottom).



ELECTRICIANS HEATING lead and preparing cable for splicing at manhole for incoming roadway lighting. Note hoisting rig used on front of truck and portable engine-generator for operating cable vulcanizer.



PRECAST CONCRETE MANHOLES of three types were used throughout. Slip joints at duct bank entrance points permit expansion and contraction through duct window. Duct forms are shown with concrete separators.

FIELD DISTRIBUTION

The present electrical distribution system for the airport is served with purchased energy from the utility company having two principal sources of current delivered to the field at two locations—one at the northwest area and the other in the northeast area. At each incoming service point and one location in the central area, a substation is provided—all interconnected. Each substation contains 27-kv. main feeders, 5000-kva. 27 to 4-kv. transformers and 4-kv. tie feeders.

On account of the large amount of corrosive chemical content in the ground water which lays in the fill around this airport, non-leaded sheathed cable was used for all types of service with the exception of the main 27-kv.

feeders which are paper and oil insulated with lead sheath and an overall neoprene protective sheath.

All 2400 and 4160-v cable has 7500-v insulation with neoprene jacket, for protection against the high open circuit voltages the runway lighting series ciruits.

The standard distribution service throughout the airport is 4160-v, 4-w, 3-ph. This is used for all series airport lighting equipment and for building services to load centers, where it is stepped down to 120/208-v, 3-ph, 4-w service for all general lighting and power purposes. All load centers are fed by dual feeders to aid continuity of service.

Standard ANC (Army-Navy-Civil) runway light bases were not adaptable to the duct system installed at this airport, so a cast concrete light box was used for each runway and taxi light—large enough to receive two 500 watt

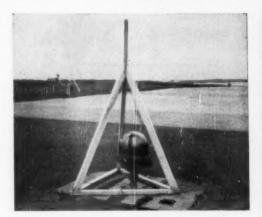
...Wiring Idlewild



TRANSFORMER VAULT in temporary Ad. Building showing some of transformer and switchgear for field lights and building power. Two static type constant current regulators are shown at lower center. Regulators include transformers and relays for five stages of brightness for runway lights.



ELEVATED TYPE TAXI LIGHTS (Crouse-Hinds Type ERL) replaced original flush type lights which became easily obscured by blowing snow or sand.



HIGH INTENSITY LIGHTS on runway "C" are Line Material controllable beam, bi-directional type. Wooden tripods over lights protect them during construction against field construction equipment.



HIGH INTENSITY LIGHTS on runway "A" are Westinghouse Type HL fixed focus uni-directional type. Each unit is wired on three separate circuits. Three insulating transformers in manhole feed lights.

insulating transformers, two 3-inch conduits and two or three series lighting circuits and control wiring. These boxes have three separate removable covers with the center cover having a standard ANC cast iron base fitting which is drilled to standard ANC centers, thereby permitting the installation of any type of fixture.

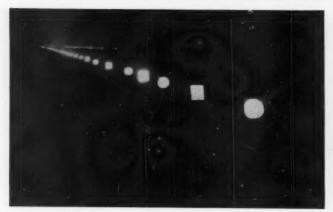
Light boxes for the runway lights are installed on 100 ft. spacings along both sides of the runways and are set 15 ft. out from the edges on the shoulders.

A rubber cord assembly for each runway and taxiway light has a quickly-detached water tight rubber connector plug and receptacle which connects the light with an insulating transformer in the manhole. In case the light is knocked over by a plane, the plug is pulled out of the receptacle—disconnecting the light from the circuit. This feature also

facilitates servicing. All lights have one inch thin wall steel conduit supports having breakable couplings at the bases in case they are hit by a plane or snow plow.

Runway "A" has Westinghouse Type HL units (unidirectional type) each having two 95-w, 6.6-a sealed beam lamps for the main beams and a 45-w, 6.6-a lamp in a low intensity bi-directional optic mounted on top. Runway "V" has Westinghouse Type BHI (bi-directional) units, each having one 200-w, 6.6-a lamp. Runway "C" has Line Material Type D-1 high intensity units each having a 200-w, 6.6-a lamp. Each unit has a beam control device consisting of a small motor and mechanism for shifting the lamp in relation to the fixture lens so as to swing the axis of the beam laterally in order to compensate for reduced atmospheric transmission of the light beam.

Outstanding Electrical Construction...



HIGH INTENSITY APPROACH LIGHTS for runway "C" are Westinghouse all-weather type consisting of 35 krypton flash units (round reflector) teamed with 35 neon blaze units (appear square) installed on pier extending 3000 feet beyond runway end, claimed to penetrate 1000 feet of zero-zero weather.



ELECTRICIANS INSTALLING krypton approach light using truck-mounted crane. Units are mounted on ball and socket type bases.



PIER TRANSFORMER VAULT for feeding runway "C" approach lights. Vault exterior walls are covered with corrugated Transite for resisting salt spray. Three vaults are installed on runway "C" approach light pier.



FLASHER RELAY PANEL for runway "C" approach lights installed in center vault on pier. Duration and frequency of flash is controllable from tower panel. George Unger (right) Supt. for Hoffman and Elias, with Louis Crisci, Westinghouse

APPROACH LIGHTING

The all-weather high intensity approach light systems installed for runway "C" and for runway "V", the new instrument runway, were designed to provide the missing link needed to assure round-the-clock, on-schedule flying by commercial airlines.

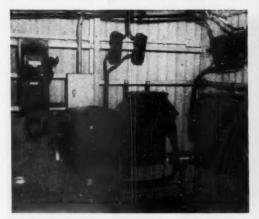
The approach lighting system installed for runway "C" was designed by Westinghouse and uses two new type lamps, a krypton flash lamp, which is several times brighter than any other known light source; and a high pressure neon tube (blaze unit). Thirty-five krypton flash units are mounted alternately in line with 35 neon blaze units comprising the approach line. The lighting units of the approach line are 100 ft. apart in the inner 1000 ft., 50 ft. apart in

the center 1000 ft., and 25 ft. apart in the outer 1000 ft.

Each light is fed from a weatherproof terminal strip junction box mounted near the light. All lights, boxes, fittings, conduits, etc., are painted to resist the corrosive effect of the salt water. Three transformer vaults are installed on the pier for supplying 120-v, single phase to the lights from the 4160-v supply.

The high intensity approach light system installed for the new instrument runway "V" is the CAA-developed Type BL "Slope Line" system. The system consists of two rows of lighting units installed on 2000-ft, long piers (also between piers and runway end) extending 3000 ft. from the south end of the runway into Jamaica Bay. The lighting units are spaced 100 ft. apart on the piers. Each unit consists of 10 sealed beam 200-w, 12.5-v lamps mounted

...Wiring Idlewild



MASTER FLASH SYNCHRONIZER shown at lower left in center vault of runway "C" approach light pier, causes flashing lights to "follow the leader". Remote control oil switches, transformer, primary fuse cutouts and safety switch are shown.



CORRECT APPROACH POSITION for CAA high intensity slope line approach lights for runway "Y". Note how individual lights appear to form two continuous lines of light leading to end of runway.



APPROACH LIGHT PIER for runway "C" showing flashing type krypton and blaze units mounted alternately. Note wire "feelers" on top each light to keep seagulls from perching on them and obscuring their 3.3 billion candlepower beams.



SLOPE LINE HIGH INTENSITY APPROACH LIGHT on one of the two 2000 ft. long piers for new instrument runway "V". Each light is 14 ft. long—has 10- 200-w sealed beam lamps and is tilted at an angle of 45 deg.

in a metal box 14 ft. long and one foot wide. These units are mounted at an angle of 45 deg. When the approaching pilot is on the right path, the two lines of light forming a funnel are uninterrupted lines of light leading to the end of the runway. However, when seen from any other point, they break up into echelon formations which, by their nature, tell him quickly, and with very little mental calculation, in what direction he is off the proper path or too high or too low. Five degrees of brightness of lights are available depending on visibility conditions and controllable from the control tower. 2300-v circuits feed 5 kva 2300/240-v transformers on the piers for the lights. Each transformer feeds two light units. Each unit has a 2½-kva dry type transformer rated at 240/12.5-v.

Outstanding Electrical Construction...



MONITOR PANEL (center) in control tower controls all ILS (Instrument Landing System) component units and shows at a glance whether or not all units are functioning properly. Panel at lower center controls and regulates brightness of all field lights.



CONTROL TOWER RADIO equipment used for communication with plane and mobile field equipment. Tower transmits simultaneously on three frequencies.



CEILING PROJECTOR (incandescent type) throws vertical light beam to cloud base. Height is determined by clinometer observation from tower.



TRAFFIC ARROWS and crosses at runway ends have 14 tubular Westinghouse units using green zeon and red neon lamps controlled from tower.



GLIDE PATH TRANSMITTER of ILS located 400-ft west of centerline of instrument runway transmits beam about 2.5° above runway.

LANDING AIDS

In addition to the high intensity runway and approach lighting the airport is completely equipped with all the latest type of lighted landing aids and wind direction indicators

A code beacon supplements the required rotating beacon. A searchlight on the tower roof is controlled by a "pilot house" control lever in the tower. Both ends of each runway have two banks of floodlights. A green traffic arrow 83 feet long at both ends of each runway indicates

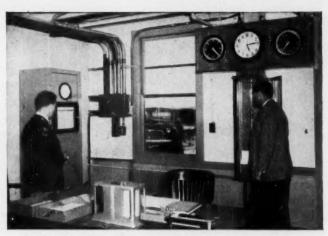
that the runway is clear for landing. The tower operator can change the arrow to a flashing red cross when the runway is not clear. Each combination consists of 14 tubular units using green zeon and red neon tubular lamps. Six smoke pots are installed around the field to indicate true wind condition to pilots. Somewhat similar to a domestic type oil burner unit, it burns heavy oil and produces white smoke. A wind tetrahedron is remotely controlled from the tower to form a landing direction indicator when desired under light wind conditions.

The CAA radio range station for the airport is located

...Wiring Idlewild



CEILOMETER RECEIVER detects reflected light from clouds produced by ceilometer projector by triangulation method—even during daylight hours.



WEATHER BUREAU electrical equipment includes automatic scanning recorder (at left) for day and night-time ceilometer projector and receiver system, wind direction and velocity indicators (at right) also, teletype equipment, facsimile transceivers, barometers, clocks, etc.



RUNWAY FLOODLIGHTS are mounted on concrete transformer vaults near both ends of each runway. Two vaults like this having two floodlights and 3,000-w., 32-v lamps on each are at runway end.



FLOODLIGHT TRANSFORMER VAULT, interior view, showing floodlight transformer, distribution transformer and remote control oil circuit breaker at right; primary fuse cutouts on rear wall and distribution panelboard at left.

several miles south of the south end of the instrument runway "V" and one leg is aligned with it. It is of the simultaneous loop type i.e., the voice does not interfere with the course signals.

The Instrument Landing System (ILS) and high intensity lighting permits straight-in instrument approaches to runway "V" with a 200-foot ceiling and ½ mile visibility for incoming aircraft.

Precision beam and airport surveillance radar (modified and improved) GCA will be placed in operation soon,

The equipment at the airport weather station includes

some of the latest developments. Foremost of these is the automatic ceilometer projector and receiver equipment which provides a highly automatic determination of the height of cloud ceilings above the earth. In contrast to conventional equipment, it is used for both day-time and night-time measurements with equal accuracy. A conventional ceiling projector is installed as an additional night-time check.

Another late development in use is a facsimile transceiver for automatically receiving weather charts from the Main Weather Bureau Office at La Guardia Field.

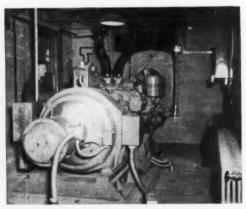
Outstanding Electrical Construction...



APRON FLOODLIGHTS have visors to confine light distribution to apron area. No light from them must be visible from approaching or landing aircraft. Note rotating beacon, green flashing code beacon and searchlight on control tower roof.



GENERATOR SWITCHBOARD is readily and safely accessible for repair. Maintenance of switch and circuit breaker units is quickly and easily accomplished. Regulator panel (second from left) has field and exciter rheostats.



STANDBY ENGINE GENERATOR automatically starts on failure of utility company's service, providing 150-kw, for all field lighting, control tower lighting and electronic equipment and emergency building lighting.

EQUIPMENT

Although there are dual utility main service feeders with an automatic changeover switch, a standby diesel engine generator is installed in the temporary Administration Building to further insure the continuity of service. It has a capacity of 150-kw., sufficient to carry the high intensity approach and instrument runway lights as well as all control tower radio equipment, ILS, GCA (ground controlled approach) and all other radio, electronic and lighting landing aids, including the emergency lights and exit signs in the buildings, weather bureau and control tower. The engine starts automatically upon complete current failure and the generator builds up to voltage and is able to carry the entire emergency load within several

...Wiring Idlewild



ROADWAY LIGHTING system and all building area exterior lighting must be designed to throw all light downward so that none will reach airborne planes and cause confusion with runway or other landing aid lighting.



HANGAR LIGHTS are 1000-w high bay prisimatic type producing 40 to 50 ft-c floor intensity. Each of the 112 units in each City hangar has Thompson lowering type disconnecting hanger, permitting it to be cleaned and relamped by one man.

seconds. The generator is 2400-4160-v, 4-wire, 3-phase. Four large circuit breaker type lighting distribution panelboards serve each large hangar area and lights are controlled in groups with contactors on the panels.

The main distribution switchboards and all lighting panelboards in the hangars are circuit breaker type. A coded box local fire alarm system is installed throughout the airport and is designed for extension to the future permanent buildings. The system includes supervisory circuits and distinctive alarm bells for the hangar automatic sprinkler systems and valves. City fire alarm boxes are installed in control tower and adjacent to hangars.

SOME OF THE ELECTRICAL CONTRACTORS AND SUPPLIERS ON IDLEWILD

Contractors

Hatzel & Buehler, Inc. Hoffman & Elias, Inc. Jandous Electric Const. Corp. Kaplan Electric Co. Lord Electric Co., Inc. Plymouth Electric Co. Frederick Snare Co.

Note: Contractors listed are only those having contracts over \$100,000.

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Orangeburg Mfg. Co.
Phelps Dodge-Copper
Products Corp.
Revere Electric Mfg. Co.

Thompson Electric Co.
Walker Cement Products
Co.
Westinghouse Electric Corp.

Engineering

Original Electrical Design Sears & Kopf, Consulting Engineers, N. Y. working under Carrillo and Green Associates, General Consulting Engineers for the City of N. Y.

From June 1, 1947
Port of New York Authority
John M. Kyle, Chief Engineer
C. R. Johnson, Electrical Engineer

TABLE I... Effect of three digit and nearest dollar extensions on sheet total

	Nearest cent	Slide rule	Nearest dollar
Ceiling outlets	103.13	103.00	103.00
Bracket outlet	18.16	18.20	18.00
Receptacle outlet	34.39	34.40	34.00
Switch outlets	31.14	31.10	31.00
Spec. outlets	.23	.23	*****
Combination outlets	.84	.84	1.00
Floor outlets	5.50	5.50	6.00
Ceiling switch outlets	2.53	2.53	3.00
Fittings	.69	.69	1.00
1/2 inch T. ceiling	7.52	7.52	8.00
3/4 inch T. ceiling	4.45	4.45	4.00
1 inch T. ceiling	2.30	2.30	2.00
1/2 inch T. wall	7.36	7.36	7.00
3/4 inch T. wall	8.05	8.05	8.00
1 inch T. wall	.69	.69	1.00
3/4 inch T floor	.04	.04	
1/2 inch, galv	403.47	403.00	403.00
3/4 inch, galv	273.38	273.00	273.00
1 inch, galv	42.32	42.30	42.00
1/2 inch flex	27.67	27.70	28.00
3/4 inch flex	24.49	24.50	24.00
Totals	998.35	997.40	997.00
error	0	95	-1.35

Comparison of accuracy of quantity times unit price extensions from a branch circuit roughing pricing sheet. The first column shows extension carried out fully. The second column shows extension carried out by 10 inch slide rule to three figures. The third column shows extension carried to the nearest dollar.

How To Estimate Electrical Work—VI

By W. T. Stuart

RANSFERRING data from the take-off sheet to the pricing sheet should follow a logical pattern. Items of conduit should be listed in ascending or descending order by size, then terminals, then els and bends, etc.

The purpose of a logical order is two-fold. First, the items are listed for convenient pricing, since catalogs and price sheets group like materials together. Second, orderly listing flags possible omissions. For instance, if 2 inch conduit is listed, there is a logical necessity for a 2 inch terminal.

Each item on the take-off sheet should be checked off as the item is transferred, then carefully rechecked to insure that all totals have been carried over. A good idea here is to have an assistant or associate also check the transfer. When items are entered on the pricing sheet, they should also be rounded to commercial quantities. Conduit, for instance, to the next 10 feet.

Pricing

The pricing sheet shown illustrates a typical method of listing items of feeder and power circuits. The take-off is from the example described on page 56 and 57 of the April issue of Electrical Construction and Maintenance. Details of the wireway and motor switches were omitted to simplify the example.

Prices in the example are listed at net cost. This represents the most common method used by estimators. The unit prices may be taken from current catalogs, wholesalers price sheets, job quantity quotations or a net price schedule. Another method of pricing,

worthy of comment here, is that of pricing units at "retail". Unit prices are taken from a price list which already contains a markup. Operation on the material totals in bid preparation are made by discount from "retail" rather than markup on net cost. This method has the quite considerable advantage of permitting negotiation with customers supported by all of the details shown in the estimate. We would appreciate comments from estimators on this type of estimate pricing.

Some estimators prefer to show unit material prices at manufacturers list less the appropriate discount. In the writer's opinion, this method introduces too many needless points of possible error. A good set of price sheets kept up to date showing net cost prices is preferable.

TABLE 2.	Fe	eders and	Powe	r Circuit	s Pricin	g She	et
	Quan.	Mater Net	ial Per	Ext.	Hours	Labo	Ext.
2 in. galv	30	42.10	C	13.00	13.50	C	4
1 1/4 in. galv	120	26.50	C	32.00	9.40	Č	11
1 in. galv	10	19.50	C	2.00	7.20	Č	1
3/4 in. galv	90	13.50	C	12.00	6.20	C	6
S. E. head & el 2 in	1	4.30	E	4.00	1.75	E	2
2 in. Term	4	17.50	C	1.00	.72	E	3
1 1/4 in. Term	10	7.15	C	1.00	.34	E	3
1 in, Term	2	6.75	C		.28	E	1
3/4 in. Term	12	4.00	C		.22	E	3
1 1/4 in. El	14	.58	Е	8.00	.80	Е	11
1 in. El	1	.43	E		.60	E	1
1 1/4 in. Bend	1				1.40	E	1
No. 2/0 R	107	170.00	M	18.00	40.70	M	4
No. 1 R	14	121.00	M	2.00	28.10	M	
No. 4 R	102	62.00	M	6.00	21.90	M	2
No. 6 R	306	51.00	M	16.00	18.80	M	6
No. 12 R	220	11.50	M	3.00	12.50	M	3
Ground clamp	1	.46	E		.65	E	1
2 in. straps brick	4	.22	E	1.00	.25	E	1
Seal wall		****	**	1.00	,		2
				\$120.00			66 hours

Pricing sheet based on feeders and power circuits (from example in April E. C. & M. page 56) illustrates logical listing sequence, specific notations, method of net pricing and "nearest dollar" extensions. (In materials column exact extensions add to \$120.08.) Labor units are extended to nearest hour. E is each, C is per hundred, M is per thousand. Prices and labor units shown are approximate.

HOW to transfer take-off to pricing sheets **HOW** to list items on pricing sheets

HOW to price individual items HOW to extend and total quantities

An interesting and very handy method of listing most used prices is on typical pricing sheets bound into a loose leaf book. The items follow the same sequence as is used in the actual estimates.

Extension

Three methods are in common use among estimators for extending unit prices on the listed quantities.

 Full extension to the nearest cent, as \$1373.49 or 42.86.

2. Extension to three significant figures, as \$1370.00 or 42.90.

Extension to the nearest dollar, as \$1373.00 or 43.00.

Each method has certain virtues in estimating. On the average estimate, any of the three methods will produce a total of sufficient accuracy. While both

the second and third introduce individual errors, they are consistent errors, both plus and minus, with the result that the individual errors tend to balance out.

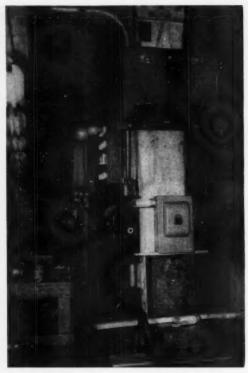
If the estimator has ample clerical help, or a fast calculating machine, extension to "nearest cent" is entirely practical and preferable. If extensions must be done by hand, many estimators feel that the slight additional accuracy of the precise figure is not worth the time required to achieve it. Slide rule extensions to three significant figures are fast and, with skill, of ample accuracy for most work. The "nearest dollar" is a newer method which offers possibilities for speedy work and ultimate accuracy well within the requirements of lump sum estimating. Any figure in the cents column less than .50 is dropped. Any figure .50 or over is entered at \$1.00.

The methods may be easily checked by selecting three or four pricing sheets at random which have been extended to the "nearest cent". Run them off on an adding machine using the extensions rounded to the first three digits and then rounded off to the "nearest dollar".

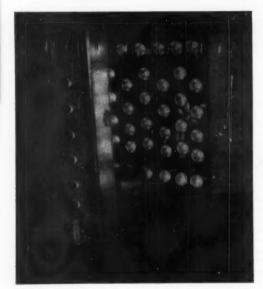
The accompanying comparison is made on the materials column extension of an actual branch circuit roughing sheet. The error on "slide rule" totals less than to of 1 percent. The error on "nearest dollar" is slightly more than to of 1 percent. Since this is a much smaller error than is probably inherent in the take-off quantities, it it is practically negligible for ordinary price estimates.



SWITCHGEAR is liberally sized to provide for shop expansion. Drawer-type construction is used, with ample gutters around breakers for wiring facility.



TRANSFORMERS and local control panels are conveniently located adjacent to the areas they serve. Distribution system follows pattern of adequate wiring.

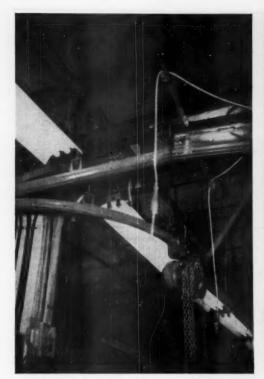


BAKING is performed in infra-red ovens, with lamps controlled in small groups by conveniently-located switches permitting close temperature control.

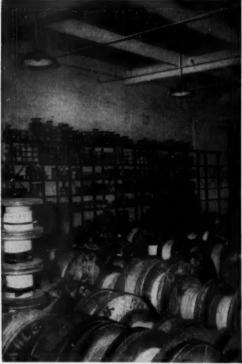
REBUILDING CLEARS BOTTLENECKS

Efficient working space, modern equipment layout and effective material handling details emerge from fire-damaged Cleveland shop.

By Hugh P. Scott



MONORAIL system serves shop, shipping, storage and loading areas. Switching system permits easy shunting of hoist-supported loads to sections desired.



STORAGE of reels and small parts is in fireproof section of brick and steel construction. Sprinkler system, steel shelving, liberal space and adequate lighting is provided.

HEN fire damaged the shop of the Elliot Electric Company, Cleveland, Ohio, and business was temporarily curtailed due to inoperative equipment, the misfortune to this successful service organization seemed great. Yet this temporary misfortune eventually contributed definite benefits for, in considering the problem of compulsory rebuilding, the limitations of the former installation were studiously avoided, an overloaded distribution system was replaced, cramped working space was expanded, obsolete equipment was replaced, and old materials handling methods were revised.

Modern Construction

The result is a modern, fireproof, roomy plant having high-level illumination, electrical service facilities liberally over-sized to carry both present and future loadings, equipment geared to today's pace, and areas efficiently planned for office and administrative work, motor repair, storage and shipping. Still in progress, the new con-

struction already indicates the pattern of a top-flight shop.

Main switchgear and control panels are now safely and liberally sized, with draw breaker construction and wide wiring gutters for connection facility. Voltage is carried through the shop at its initial level from switchgear to utilization areas where it is stepped down through dry-type transformers for local use, thus reducing voltage drop and the amounts of copper required for service distribution.

An overhead monorail system now serves the repair, storage and shipping areas, with a manually-operated switching system to shunt hoist-borne loads with maximum convenience and minimum effort. This same system carries loads from trucks to freight elevator and also serves the dipping tanks and baking ovens.

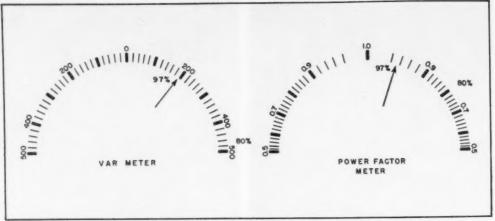
Ovens utilize infra-red lamps, switched on and off in small groupings, making it possible to localize heat where desired and to control temperatures closely.

The storage areas are brick and steel construction, with sprinkler protection as well as automatic fire doors, and with tiers of steel shelving for small wire reels, liquid containers, small parts and materials. Large reels are placed directly on the reinforced-concrete floor, with ample aisles for easy access,

The modernized shop is not only efficient in layout and operation but it is a fine example of selecting and installing electrical equipment with the wisdom of experience.

Opportunity for Revemping

Shops seldom have the chance to put hind-sight into practice, although machines become antiquated, distribution systems become overloaded and floor layouts become cramped. Such an opportunity, in the form of an apparent misfortune, came to the Elliott Electric Company and, through sound evaluation and replanning, their compulsory rebuilding program resulted in the elimination of production bottlenecks.



DIFFERENCE IN SCALE presentation between the varmeter and the power factor meter.

VARS versus P.F.

How and why varmeters are replacing power factor meters in the measurement of reactive power in industry.

THE use of varmeters in place of power-factor meters is now a recommended part of conventional measuring equipments.

This is due to the fact that in recent years there has been an increasing acceptance of the use of vars in the measurement of reactive power.

For the benefit of those still accustomed to the use of power-factor meters, it might be well to review some of the factors that led up to this change in practice.

Power-factor meters were developed and introduced years ago when, from the standpoint of machine performance, power output and power factor were given first consideration, and the advantages of using vars for over-all system operation were not fully recognized.

However, with the increased number and interconnections of large systems it became apparent that the use of vars was essential, and that there should be the same means of obtaining measurements of vars as of watts. Watts (active power) and vars (reactive power) are both definite quantities, and should be treated as such by electrical system operators and dispatchers. This has been recognized by some utilities, who have taken steps to educate their operators in the dispatching of vars just as they would

P. F. non-linear

Power factor is a non-linear ratio of watts to volt-amperes and in the higher values deceptively minimizes the magnitude of vars.

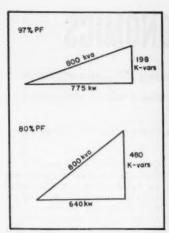
For example, the torque of the varmeter varies with the sine of the angle of displacement, whereas the torque of the power-factor meter varies with the cosine. Therefore, at high power factors the pointer deflection of the varmeter is appreciably more than the pointer deflection of the power-factor meter. Assuming a displacement of 14 degrees, the cosine (or power factor) is approximately 97%, which is not far from unity.

On the other hand, the sine (or reactive factor) is nearly 25%, which is considerably above zero. An operator might not be concerned by a 97% reading on the power-factor meter; yet would be greatly concerned if he realized that a 25% component of the current was idle. Assume a circuit rated 800 kva. operating at 97% pf or 775 kw and 198 kvar full load. Fig. 1 shows a comparison of the varmeter and power-factor meter scales. From this illustration it can be seen just where the pointer will deflect. At 80% pf the varmeter would indicate 480 kvar at full load.

Vectors

The vector diagrams (Fig. 2) show more clearly the magnitude of vars as compared to the watts and the voltamperes given in the example.

In comparing the two instruments, it should be noted that the power-factor meter is essentially a single-phase instrument, hence is not accurate on unbalanced loads. The polyphase



COMPARISON OF KILOWATTS and kilovars for 800 kva. at 97 percent and 80 percent power factor.

By Harry S. Edgerly

Switchgear Division General Electric Company

varmeter, however, is accurate under any unbalanced load conditions.

The terms "lag" and "lead" as applied to power factor are meaningless except when referring to the direction of power flow. This confusion is avoided by the use of vars "In" and "Out".

Even in those few cases where it may seem desirable to use a common power-factor meter for several machines or power circuits, the instrument might preferably be a varmeter with scale marked in secondary vars. Actually, for reasons of simplicity, reliability and safety, is its preferable, for applications of this kind, to use an individual set of instruments and meters for each machine or power circuit.

Despite the fact that the varmeter is the better istrument, some operators desire to know and talk in terms of power factor. They dislike the necessity of obtaining this information by mathematical process from the wattmeter and varmeter readings. The

WER FACTOR NOTE TO FIND % POWER FACTOR CONNECT KNOWN KW AND KNOWN RKVA WITH STRAIGHT EDGE AS INDICATED BY BROKEN LINE. READ % PF WHERE STRAIGHT EDGE CROSSES DIAGONAL SCALE

USEFUL NOMOGRAPH for finding power factor from kilowatts and kilovars.

use of a nomograph (Fig. 3) eliminates this objection and furthermore, more accurate results are obtained by this method than is possible to obtain from the readings of a power-factor meter.

The power-factor meter has only one current coil which assumes a balanced load condition whereas the varmeter is in reality a standard wattmeter with two current and potential coils having, by means of an autotransformer, a phase shift of 90 degrees in connections to obtain a reading in vars.

Another disadvantage of the powerfactor meter is its application to circuits where reversal of power flow is expected such as on a tie line. For this application either a special instrument is required or a current reversal switch either of which is undesirable.

To summarize, the varmeter has these distinct advantages over the power factor meter:

- The scale deflection is greater at higher power factors and more truly represents the magnitude of reactive power.
- The varmeter being a polyphase instrument gives an accurate reading of total reactive power.
- The direction of flow of reactive power is read directly on the instrument scale without the use of reversing switches,
- Where readings of power factor are needed, more accurate results can be obtained from the use of a nomograph to translate var and watt readings into power factor.

SCHOOL LIGHTING ECONOMICS

A comprehensive cost comparison and analysis covering 23 different lighting systems commonly used to light the modern standard school classroom.

By John J. Neidhart, Lighting Engineer, Lighting Division, Westinghouse Electric Corporation, Cleveland, Ohio

THE large variety of light sources and types of lighting equipment available today make it difficult to select the best lighting for school classrooms commensurate with the economic means of the school. For this reason, the following study has been prepared to permit an extensive comparison of the many sources, types of luminaires, and lighting layouts that may be employed to light school classrooms. A typical classroom 24' x 30' with a 12' ceiling height, was selected as a basis for this study.

Cost Analysis

The complete study is built around a cost comparison of 23 different lighting systems in a standard classroom. The anlysis was based upon a 2½-cent power rate, 1,000 hours annual operation, and a ten-year amortization period. Complete details of the installations compared and the summarized results of the analysis are given in tabular form in Table I.

The primary comparison points in the cost analysis are: (1) the total initial investment, and (2) the total annual lighting cost. The total initial investment is significant in that it shows the amount of money that must be raised to make the installation. Unfortunately, this initial cost is frequently used as the sole means of comparing the costs of proposed installations, and the installation selected on this basis may actually prove to be the most expensive in the long run. A much truer comparison is given by

the total annual lighting cost which includes the amortized installation cost and the operating cost. This annual cost will conform with the actual annual charges and expenses as they will appear in the financial records of the school. To facilitate direct comparison, the annual lighting cost has also been expressed in terms of the relative annual lighting cost, with the least expensive installation having a relative cost of 1.00.

One fallacy in a comparison of the total annual lighting costs is that some of the apparently more expensive systems are really providing considerably more illumination. To determine the true economics of the various systems, the annual cost per footcandle for each system should be compared—

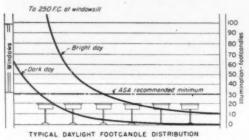


FIG. 1—Daylight alone never provides adequate illumination for all desks in rooms with conventional fenestration.

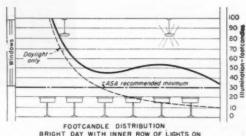
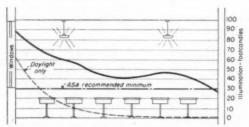
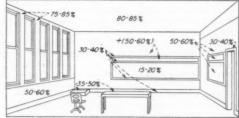


FIG. 2—Inner row of lights only need be lighted on bright days to provide adequate illumination on all desks.



FOOTCANDLE DISTRIBUTION DARK DAY WITH BOTH ROWS OF LIGHTS ON

FIG. 3—Both rows of lights are required on dark days to provide ASA recommended minimum illumination.



RECOMMENDED REFLECTION FACTORS FOR

FIG. 4—Light room surface and furniture finishes are essential for efficient light utilization and comfortable seeing conditions.

					ABIE (-(ABLE 1 - COST COMPARISON	ARISON C	COVERNG 23 DOFERBAT	23 DAFFER	BAT LIGHTING	ING SYSTEMS	2	A STANDARD	SCHOOL	CLASSROOM								
LIGHTING SYSTEM NUMBER	-	2		•	*	9	7		•	10	=	12	13	14	15	16	17	18	19	2	11	11	22
LIGHTING LAYBUT		0 0 0	0 0 0	0 0 0	 	1000					CEARES												
TYPE OF LAMP	-	INCAMBITICIE				5748848	PREMIAN	44" RUBBRICHE	18.E	A	LANY SENSORTHEESS PLUGGESTICKET	¥	0 0	0 0							-		1
LAMP DESCRIPTION	500 WATT	500 WATT	750 WATT	40 WATT	40 WATE 7-12	40 WATT	40 WATI T-12	40 Waff	40 WAT!	40 WATT	46 WAIT 1-12 66"	25 WATT (625 MA)	PS WATE (425 Ma) F-13	PS WATT OZS MA] 	94 WATT [000 MA] F-13	1000 Maj	94 WAIT (400 MA) 7-12	94 WAIT (400 MA)	34 WATT (120 MA)	51 WATY (250 MA)	60 WATT (300 MA)	40 WATT (300 RA)	1300 MATT (300 MA)
TYPE OF LUMBRAINE	CHARBAL DIFFUSE	LUMINOUS	LUMBIONI HIGHIOTE	BIBICT. JHDIBICT®	BHRCT. HIDIBICT®	BIRECT. IMBIRICT ®	BARECT. ANDHRECT®	BARECT.	SERO.	SERV. IMBARICT	BIRECT.			PHENCY.	DIRECT.		-	SSMI.	MARCO.	~=			34.80- 1000481 CT
NUMBER OF LUMINAIRES	9	6	•		00	12	=	12	7	22	20	•	-	•	•	•	-			•			•
NUMBER OF LAMPS PER LUMINAIRE	-	-	-	*	*	4	2	2	-	2	2	1		-	2	2	-		-	-	2		*
TOTAL LUMINAIRE WATTS (including sexificity)	800	200	750	195	195	195	87.6	97.5	195	97.5	108	195	390	390	247	247	161	161	2	344	111	354	354
TOTAL WATTS CONNECTED	3000	4500	4500	1170	1560	2340	1365	2050	2730	2730	2160	1755	1560	2340	1485	2220	1975	2962	1503	1585	1590	2125	3185
DUTIAL LAMP LUMENS PER LUMBNARE (besed upon white lamp)	0566	0546	15,500	9920	9920	9920	4960	0477	9546	4960	8400.	0096	19,200	19,200	11,600	11,680	23,200	23,200	9,130	13,200	8,700	17,400	17,400
AVERAGE FOOTCANDLES MAINTAINED	23.0	25 0	26 €	23 €	32	*	23 e	2	×	2	16	33	30	45	27.0	9	*	35	8	=	=	=	88
TOTAL INSTALLATION COST (LESS LAMPS)	\$175.00	\$310.00	\$315.00	\$369.00	\$470.00	\$628.00	\$508.00	\$732.00	\$845.00 \$	\$1043.00	\$1328.00	\$594.00	\$436.00	\$ 603.00 \$	\$484.00	\$685.00	\$496.00	\$725.00	8685.00	\$514.00	8551.00	\$543.00	\$820.00
COST OF INITIAL LAMPS AND STARTERS	\$5.10	\$7.65	\$15.60	\$32.40	\$43.25	\$64.80	\$37.80	\$56.70	\$75.70	875.70	\$78.90	\$50.00	\$44.50	\$46.75	\$33.40	\$50.00	\$44.50	\$44.75	\$83.00	\$55.25	\$41.40	\$55.25	\$83.00
TOTAL INITIAL INVESTMENT	\$180.10	\$317.65	\$330.60	\$401.40	\$513.25	\$692.80	\$545.80	\$788.70	\$920.70	\$1118.70	\$1406.90	\$644.00	\$480.50	\$669.75	\$517.40	\$735.00	\$540.50	\$7.191.75	\$768.00	\$569.25	\$592.40	\$598.25	\$903.00
MAINTENANCE Lamp and Starter Renewals and Cleaning	\$11.10	\$15.75	\$21.90	\$15.32	\$20.46	\$30.64	\$24.85	\$37.31	\$39.27	\$62.37	\$65.75	\$35.20	\$23.30	\$34.95	\$23.48	\$35.20	\$23.30	\$45.75	\$48.95	\$32.65	\$33.48	\$32.65	\$45.15
POWER-Annual KWH x \$.025 Power Rate (1000 hours entered operation)	\$75.00	\$113.00	\$113.00	\$29.20	\$39.00	\$58.60	\$34.16	\$51.25	\$48.40	848.40	\$54.00	\$43.85	\$39.00	\$58.50	\$37.15	\$55.50	\$49.40	\$74.20	\$37.60	839.60	\$39.80	\$3.15	879.60
ANNUAL OPERATING COST Sum of Maintenance and Power	\$86.10	\$128.75	\$134.90	\$44.52	\$59.46	\$89.24	\$58.95	588.56	\$107.67	\$130.77	\$119.75	\$79.05	\$42.30	\$93.45	\$60.63	\$90.70	\$72.70	\$6.9118	\$89.55	\$77.25	\$73.28	\$85.00	\$144.75
FIED CHARGES—Installation cost emeritaed over 10 years with additional 5% charge for interest and insurance	\$26.25	\$46.50	\$47.25	\$55.35	\$70.50	\$94.20	\$76.20	\$109.80	\$126.75	\$156.45	\$199.20	\$49.10	\$45.40	\$90.45	\$72.60	\$102.75	\$74.40	\$108.75	\$102.75	877.10	\$42.65	\$11.65	\$123.00
TOTAL ANNUAL LIGHTING COST Sum of operating cost and fixed charges	\$112.35	\$175.25	\$1.2918	28.665	96 6218	\$183.44	\$135.15	\$198.36	\$234.42	\$287.22	5531835	\$1.8918	\$127.70	\$183.90 \$	\$133.23	\$193.65	\$147.10	\$228.70 \$	\$189.30 \$	\$149.35	8188.93	\$167.25	267.75
RELATIVE ANNUAL LIGHTING COST	1.10	1.72	1.78	1.00	1.30	1.83	1.35	1.98	2.34	2.87	3.19	1.68	1.28	1.84	1.33	1.93	1.47	2.29	1.89	1.49	1.56	1.67	2.68
AMMUAL COST PER FOOTCANDLE	84.88	\$7.02	\$7.02	54.34	\$4.06	\$3.82	24.66	\$4.62	16.95	\$1.46	\$10.27	\$5.10	\$4.26	\$4.09	84.94	MB	\$4.09	\$4.53	11.95	\$4.82	\$5.03	\$4.08	28.87
RELATIVE COST PER FOOTCANDLE	1.28	1.84	1.84	1.14	1.04	1.00	1.22	121	181	2.27	1.69	1.34	1.12	1.07	1.30	171	1.07	171	1.60	1.26	1.32	1.07	1.80
A ALL DIRECT HERMAN STRUMEN TO BE FOR	IL CONTROL	10k 30' 1 30'	Street agent	DOOR AND DOOR	Same and	Street Street	•	-		-	-	-											

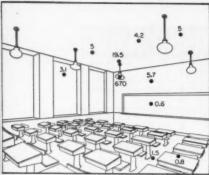


FIG. 5—High brightness ratios between lighting units and adjacent surfaces result in annoying, uncomfortable glare.

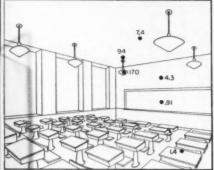


FIG. 6—Low brightness ratios and comfortable illumination are provided by lluminous indirect incandescent units.

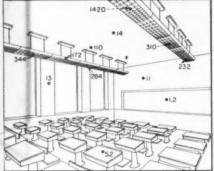


FIG. 7—Direct-indirect fluorescent luminaires with louver bottoms provide comfortable seeing, have high utilization, and require minimum maintenance.

or the relative cost per footcandle may be used to show the results more readily.

It should be understood that the installation costs include estimated costs of wiring and installation in a new building or in an old building in which complete rewiring is necessary. Some of the systems may be readily adapted to existing electrical facilities in old classrooms and would show greater economies since no rewiring would be required. For example, many classrooms have six outlets with a capacity of only 200 watts per outlet. Installation of initially inexpensive 500 watt enclosing globes (System No. 1) would require rewiring, but System No. 4 could be installed without any rewiring expense. Thus, the advantage of System No. 3 over No. 1 would be even greater than indicated in the analysis. Similar savings can be seen for other systems with different combinations of existing facilities. System No. 5, for example, works out very well in a 4-outlet classroom.

Illumination Level

Current recommended illumination levels as established by the American Standards Association in the 1948 Standard Practice for School Lighting are listed in Table II. It should be noted that a minimum level of 30 footcandles should be maintained in classrooms. The many combinations of sources, luminaires, and luminaire arrangements used in the cost analysis resulted in a rather wide range in illumination levels, with several of the systems providing less than the required minimum. These systems (Nos. 1, 2, 3, 4, 7, and 15) were included, however, because of their popularity in schools with limited funds. It can be seen that the apparent economies of such installations are almost invariably false.

In calculating the illumination levels shown in the cost analysis, it was assumed that maintenance conditions would be good. That is, burned out lamps would be replaced promptly, proper voltage would be provided, and luminaires would be cleaned regularly

(two times a year for direct-indirect luminaires and three times a year for indirect and semi-indirect luminaires). Lower illumination levels may be expected with poorer maintenance than stipulated.

The illumination provided by daylight has been disregarded in the analysis, because it is so variable and could be considered the same for all systems. Even on bright days, daylight illumination is insufficient for the inner rows of desks (Fig. 1). On dark days, it is not adequate for any desks. The inner row only of a two row fluorescent system (such as No. 6) is shown to be adequate for a bright day. However, on dark days, both rows are required to obtain adequate results.

Quality of Light

Just as adequate quantity of illumination is essential for quick, accurate seeing, proper quality is also necessary for visual comfort and ease of seeing. The effects of bright, glaring installations are so harmful to the eyesight and physical well-being of the children that it is better to sacrifice some quantity when necessary to ensure proper quality. Lamp brightness must be shielded from direct view and luminaire brightness must be controlled to acceptable values. Room surfaces must be well lighted to limit brightness ratios to the approximate recommended ranges (Table III). Such ratios can be more easily obtained if room surfaces have reflection factors conforming with those recommended in the 1948 American Standard Practice for School Lighting. (Fig. 4).

Brightness distributions for three basic types of lighting installations are shown in Figs. 5, 6, and 7. The high brightness ratios and glaring conditions shown by Figure 5 are typical of the results that may be expected from System No. 1. This system will actually produce even worse results since it utilizes 500 watt lamps, and the data shown is for 200 watt units. Much improved results can be obtained from System No. 2 as shown by Fig. 6.

[Continued on Page 139]

TABLE IC — ILLUMINATION LEVELS AT THE WORK (CURRENT RECOMMENDED PRACTICE)	MINIMIJM
LOCATION	FOOTCANDLE
Classrooms — Dasks, Chalkboards	30
Study Hells, Lecture Rooms, Art Rooms, Offices, Libraries, Shops, Laboratories	30
Drafting, Typing, Sewing	50
Reception, Gymnesium, Swimming	20
Auditoriums, Cafaterias, Locker Rooms, Washrooms, Stairways	10
Open Corridors, Sterarooms	5

	IN SCHOOLROOMS			
		-	RAT	105
(a)	Tesk to Adjacent Surface	1	to	1/3
(b)	Task to Remote Barker Surfaces	1	to	1/1
(c)	Task to Remote Brighter Surfaces	- 1	20	10
(d)	Luminaires or Windows and Adjacent Surfaces	20	fe	1

where Reliability counts the most depend on National Electric



These National Electric Style RR Flexlay Cables are CAA approved. After rigorous tests, they are now included on the "List of Approved Lighting Equipment" as covered by Civil Aeronautics Authority Specification L-824 "Underground Electrical Cables for Airport Lighting Circuits."

NE Flexlay Cables are dependable for the continuous service conditions required by airports. With plenty of built-in "abuse resistance," they are ideally suited for underground installation—either direct burial in the earth or pulled in conduits.

National Electric CAA-approved cables are recommended for airport lighting and signal circuits, as well as for street and highway lighting, municipal, power and other installations where maximum dependability is desired for underground wiring. The tough, specially-compounded Neoprene sheath affords complete protection against the destructive forces below the earth's surface, and gives outstanding protection when exposed to the sun and weather.

Depend on National Electric CAA-approved cables for safe, reliable operations in your next airport installation. Approved under specification L-824



TYPE "A" PERFORMANCE CABLE

Flaxley, Style RR, Airport Lighting Cobis, 600 Velt Reting, AWG Sizes 4 through 16. (Single and Multiple conductor evallable)



TYPE "B" OZONE RESISTANT CABLE

Flexiny, Style RR, Airport Lighting Cubis, 3000 Velt Rolling, AWG Sizes 4 through 10. (Single and Multiple conductor available)



TYPE "B" OZONE RESISTANT CABLE

Flexiay, Style RR, Airport Lighting Cable, 5000 Voit Rating, AWS Sizes 4 through 8. (Single Conductor)

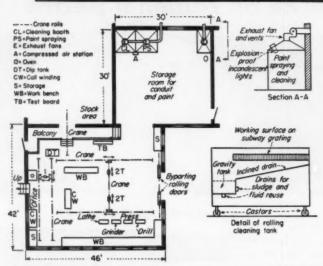
Light in weight—Flexible
Easy to handle

National Electric

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Motor Shops



SHOP LAYOUT, segregating all operations, is functionally planned for receiving, stripping and repairing motors. Safety is insured by explosion-proof lighting and high-capacity exhaust system over cleaning and spray booths. Practical equipment includes rolling cleaning tank having subway grating for working surface, inclined drain board to carry cleaning fluid to gravity tank, bottom drains for removing sludge and salvaging fluids, and casters for rapid movement of tank between working areas.

Shop Has Functional Layout

Functional arrangement of equipment, working areas, storage space, shipping entrances and materialshandling facilities characterize the motor repair shop of the Steele Electric Equipment Company in Niagara Falls, New York, supervised by Ralph R. Barker. To facilitate the handling of heavy equipment and materials, bi-parting doors permit trucks to roll directly into the shop from their rear parking space, overhead 2rail cranes completely service the repair, rewinding and storage sections, while rolling dollies, work-benches and caster-mounted cleaning tanks can be quickly shifted about the shop for maximum efficiency.

All areas requiring exhaust provisions (such as cleaning, spraying and coil burning) are located in a segregated bay, and a station to provide air at 45 pounds compression is located conveniently between the two booths requiring this service (for cleaning and spraying). All booths are equipped with overhead vaporproof incandescent lighting units and ceiling exhaust vents and ducts.

The main portion of the shop is bordered with work benches positioned beneath liberal window expanse, and a low balcony serving as a loading platform for stock items as well as a covering over the floor-based storage area for reels. Dipping tank and coil baking oven are conveniently paired beneath a 1-ton crane, and a lathe, grinder, drill and press are located adjacent to those areas requiring machine tools. Drawers beneath work benches and cabinets over the working surfaces provide ample storage space so that neatness of appearance is maintained at all times. General illumination is achieved by patternpositioned incandescents, augmented over specific work centers by functionally-placed fluorescent and incandescent fixtures. Sliding fire doors protect entrances leading from the shop to office and storage divisions.

Testing facilities are comprehensive and coil-winding facilities are extensive for, in the Buffalo area, motors in operation include ac 2-phase 110, 220 and 440-volts 25 cycle; ac 3-phase 220 and 440-volt 25 cycle; ac

3-phase 220, 440, 550 and 208-volt 60 cycle, and dc from 10 to 250 volts. Because of this variety, it is frequently difficult or expensive to duplicate the original motor characteristics and it has become the policy of the shop to first urge the purchase of an entirely new motor if it is obtainable, explaining the features of both high and lowcost units to the customer. Then, if obtaining or selling a new motor is not possible, it is suggested that a completely rebuilt motor be taken in exchange, thus minimizing shut-down periods. Of course, the advantages of a complete overhaul are explained and a year's guarantee is given with each unit purchased on this basis. Only as a last resort and on direct order from a customer are coils alone installed.

The Steele motor shop picks up, repairs, delivers, exchanges and installs motors and control equipment. However, the Steele organization includes two other divisions, one for wholesale supply and the other for electrical construction. As a result of this diversity, the Steele Company can justify the stocking of a wider variety of items than would be possible if only one department was involved.

Future plans include the installation of a new monorail crane system serving all areas by means of curved tracks and switching devices, a new testing panel and control center, and some new equipment for winding, baking, lathe and machine sections.

Use Steel Tank For Burnout Oven

Before coils are pulled from stators in the motor repair department of Houston Armature Works, Houston, Texas, the units are placed in a burnout oven to char the copper insulation. Once this covering has been reduced to ashes, it is a simple chore to remove the copper from the stator slots.

A discarded steel tank, with an inside diameter of 38 inches, serves as the oven enclosure; is mounted upright on four heavy angle-iron legs about 30 inches above floor level; has a 30-inch high opening in one side through which the stator is placed over the burner. Two hinged steel doors of 22½-inch width (arc) can be clamped shut after the stator is in the oven.

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When you specify a Fairbanks-Morse motor, you're specifying security—long time satisfactory performance that helps keep your customers sold on your product and service. From the first day, their

well-recognized name plate gets customer satisfaction off to a good start ... and through each hour they're at work, Fairbanks-Morse motors demonstrate the smooth-running, trouble-free operation that enables you—and your customers—to forget motor problems. It's a good habit ... specify Fairbanks-Morse and feel secure.

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It's good to know, when you buy or specify Fairbanks-Morse motors, that you're getting long-term responsibility and continued interest in their performance. This is typical of Fairbanks-Morse, one of the oldest motor manufacturers, backed by strategically located sales centers-and a large and active service organization. Factory-trained

Fairbanks-Morse service men are always at your service, to see that you and your customers get maximum satisfaction from motors bearing the Fairbanks-Morse name plate.

Think of this and its advantages, before you buy any motors.



The Motorgear

industry's most compact slow speed unit, combining the Axial Air Gap Motor with simple sturdy gear train.



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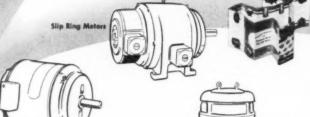
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FOR SECURITY... in Specifying Motors for Special Services!

For motor applications where conditions demand special design-whether for particular load characteristics, and operating conditions involving excessive heat, moisture, dust, etc.-chances are good that you'll find a motor in the Fairbanks-Morse line that meets your special requirements.

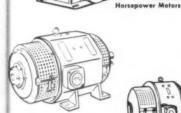
Over the years, Fairbanks-Morse engineers have designed and built motors for practically every type of "special" job, and many have taken their place in the standard Fairbanks-Morse line. For information on these and all other Fairbanks-Morse motors, write the nearest sales center listed on these pages.

This handy "pocket panorama" lists and describes the broad line of Fairbanks-Morse motors. Write your nearest Sales Center for your copy.



Fractional

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CONVERTED TANK is used as burnout oven at Houston Armature Works. Track-type dolly loads oven and centers stator over gas burner.



CIRCULAR BURNER covers almost entire bottom of oven; provides evenly distributed low-heat gas flame that chars windings without warping motor

The two-section tank provides an inside clearance of 46 inches (height); is equipped witth a two-section circular low-heat gas burner at the bottom and a natural draft duct at the top. Two angle-iroń "rails" guide a 28-in. by 36-in. steel grid-type dolly over the center of the burner; extend 34 inches beyond the oven circumference so the dolly can be rolled out for easy loading and unloading. Heavyduty grooved casters keep the dolly on the track rails which are supported at 32-inch level by angle-iron legs with suitable vertical and horizontal bracing.

Slot in Oven Roof Is Shop Labor Saver

Raising heavy winding assemblies from a dipping tank, shifting them to a baking oven and suspending them in position is a simple, continous action in the motor repair shop of the Reserve Electric Company in Cleveland, Ohio. For an electric chain hoist is used to supply the lifting power, an overhead monorail permits the hoist



Here are typical examples of Impactool savings:

Fabrication job—

60 units per day with hand wrenches 150 units per day with Impactool \$197 Impactool paid for in 11 days

Maintenance job-

90 minutes by hand wrenches 9 minutes by Impactool \$110 Impactool paid for itself in 10 days

Tube Rolling job—

80 man hours by hand tools 16 man hours by Impactool \$165 Impactool paid for itself in 13.8 hours use

Assembly Operation—

3 minutes, 48 seconds by hand wrenches 1 minute, 50 seconds by Impactool \$110 Impactool paid for itself in 15 days

Size 4U-36" cap. Available in 2 popular sizes-Size 8U-5/8" cap.

No Kick No Twist to Operator No Motor Burn Outs, can't stall motor

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GREATER STRENGTH

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Buy McGill lamp guards and you've got the best . . . the strongest . . . the longest lasting guards you've ever seen. Compare McGill with any other guard. Point for point — in cages, handles, sockets or cords, — you will see the superiority of McGill that means longer service and better protection from lamp breakage. No matter what your guard needs may be, there is a built-to-be-better McGill lamp guard to fit the bill exactly.

The most popular series made. Has strong wire cage and molded rubber handles. Strain relief disprotects cord terminals. The same construction with wooden handles is available in the 8000 series.





Where gas, fumes or dust create hazardous conditions, McGill vaporproof guards offer the utmost in lighting protection. Choice of several models to fill every need.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER



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ONLY MIGILL MAKES Levelier SWITCHES



SHIFTING of dipped assemblies from the dipping tank to the center of the baking oven is facilitated by a monorail-borne chain hoist and a slot in the roof of the oven, permitting the chain to puss the door line.

to travel directly from tank to oven, and a slot in the roof of the oven allows the chain to pass the normal door line and carry the dipped unit to the center of the heating chamber. After the chain has passed through this roof slot to the desired position, the narrow opening is closed by means of a T-shaped section which slides into the slot and seals the roof. By using this simple procedure, handling is reduced to a minimum, there is no need to shift armatures to dollies and loads are handled rapidly by remote electrical control.

The floor of the electric oven is covered by sheet asbestos which is disposed of as it becomes saturated with the insulating varnish that drips from the various dipped assemblies. Lighting is supplied inside the oven from incandescent explosion-proof units, and forced circulation of hot air promotes thorough baking. The oven, designed and constructed in the Reserve shop, includes automatic regulation for both temperatures and baking cycles.

Metal Cylinders Pay-Out Magnet Wire

A simple and effective wire dereeler, designed and built by Dowzer Electric Machinery Works, Inc., Mt. Vernon, Ill., for use in their motor repair department, uses metal cylinders to keep wire from snagging during pay-out to the winding head. Reels lie flat on the floor while the one-inch clearance between reel and cylinder keeps wire "in line" as it unwinds.

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of SWITCH BOXES

For Rigid Metallic Conduit KO's for 12 conduit. 2 wide. All 3 long, except CB.





CL and CD CL 2" deep CD 2); deep



CW and CY





For Non-Metallic Flexible Tubing KO's for 1/2 conduit...Pri-outs 21/32 All 2 wide, 3" long.



C-1 CLAMP
Used in LC, LCLE, LCV and Both 2 14" deep LO—No clampa





Both 2 14" deep LOLE—No clamps



LCV and LOV Both 214" deep LOV—Ne clamps



For Non-Metallic Flexible Tubing or Non-Metallic Sheathed Cable

KO's for 1/2" conduit, Pri-outs 21/32. All 2" wide, 3" long—Beveled.



C-13 CLAMP





LCNLE





802-SN 214" deep

For Flexible Metallic Conduit and Armored Cable KO's for 1/4" combuit. Pri-outs 21/32". All Z" wide, 3" long—Bevelen.



C-3 CLAMP



LX and LXM



LXLE and LXMLE
LXLE 215° deep
LXMLE 2° deep



LXV and LXMV



For Non-Metallic Sheathed Cable KO's for 1/2" conduit. Pri-outs 21/32"



C-5 CLAMP



LXW and LXMW



LXWLE and LXMWLE LXWLE 214" deep LXMWLE 2" deep



LXWV and LXMWV LXWV 212" deep LXMWV 2" deep



806-SW and 807-SW 806-SW 21/2" deep 807-SW 2" deep

Non-Gangable Boxes Both 2" wirle, 3" long, Pri-outs 21/32"





C-5 Clamp





Solid Flush Type Boxes For Tile or Marble Walls Both 3 deep. 3- long



GW-135



GW-235 Two Gang 3% wide



GW-335 Three Gang 5-9/16" wide



GW-435

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Die Stock that

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New JAM-PROOF drive plate automatically kicks out driving ratchet pawl when standard length thread is cut.... You don't have to watch it—lead screw can't jam on workholder.



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Perfect threads on 1" to 2" pipe with 1 set of high-speed steel dies—sets to pipe size in 10 seconds—mistake-proof self-centering workholder sets instantly—and now it's JAM-PROOF.

Buy new JAM-PROOF RIB⊇ID 65R at your supply house



THE RIDGE TOOL CO. • ELYRIA, OHIO



REELS LIE FLAT on floor inside cylinders. Clearance between reel and cylinder keeps wire "in line" while it unwinds. Note guide ring on crossbar above reel.



WIRE DE-REELER with metal cylinders to pay-out magnet wire without snagging. Ball bearing guide rings are directly above reels.

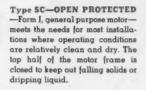
The de-reeler frame is constructed of 1½-inch angle iron; is 36-inches long, 42-inches wide at top, 41-inches high; has two 1-inch angle-iron crossbars to which are welded guide rings (ordinary ball bearings) through which the wires pass on their way to the tension bracket. Each cross bar has four guide rings. A single ring, welded to an adjustable block at the front of the frame, guides the grouped wires into the tension device.

Most of the sheet metal cylinders are 20-inches high with diameters varying with the size of reel to be used. A 12-inch reel requires a 14-inch diameter cylinder. Other cylinder diameters are 8-inches and 7-inches. If smaller wire reels are used, they are placed in metal "cans" which rest on the reels already enclosed by a cylinder. Both the larger and smaller reels can pay-out simultaneously without snagging.

The basic de-reeler frame also has removable shafts for holding reels of odd-size magnet wire when needed. The entire unit is securely mounted to the floor.

There's a Century MOTOR To Supply Dependable Power For All Popular Applications

POLYPHASE



Type SC—SPLASH PROOF gives the necessary protection where plants must be washed down—keeps water out of the motor even when a hose is applied directly on the frame. Also provides protection against rain, snow, sleet and ice for outdoor installations.

Type SC-TOTALLY EN-CLOSED FAN COOLED—protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

Type SC—EXPLOSION PROOF protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.

Type SR—SLIP RING—wound rotor motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.

Type SY—SYNCHRONOUS MOTORS- suitable for continuous operation at a uniform load for power factor correction.

SINGLE PHASE

Type RS—REPULSION
START INDUCTION—single
phase brush lifting motor suitable
for applications requiring high
starting torque with low starting
current.

Type CSH—CAPACITOR START INDUCTION—single phase motor suitable when high starting torque with normal starting current is required.

Type SP—SPLIT PHASE, IN-DUCTION—single phase motors —suitable for light starting duty.

DIRECT CURRENT

Type DN—DIRECT CURRENT MOTORS—suitable for use where direct current is available or its use desirable.

These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.

Specify the right Century motor for all your electric power requirements.

Popular types of standard ratings are generally available from factory and branch office stocks.

CENTURY ELECTRIC COMPANY

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64

You can be SURE.. IF IT'S Westinghouse

Tomorrows

Uniform Design in NEMA Sizes 0 through 4 •• to 100 hp, 600 volts Westinghouse

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Starter, TODAY!

New Westinghouse <u>Life-Linestarter</u>*

FOR BETTER MOTOR PROTECTION ... LOWER OPERATING COSTS

This all-new line of a-c motor starters is announced only after 6 years' actual trial service, backed by 40 years of user experience in building motor controls.

HERE'S WHY it IS tomorrow's starter, TODAY:

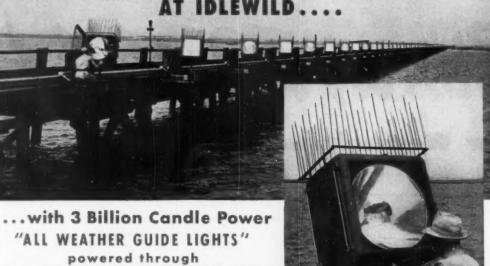
- Eliminates Solenoid Friction and Misalignment—Inverted clapper-type magnet balanced on knife-edge.
- Prevents Accidental Opening or Closing of Contacts—Seesaw balance of clapper prevents accidental opening—kickout spring prevents accidental closing.
- Provides Uniform Line—Appearance and construction, NEMA sizes 0 through 4.
- Provides Positive Opening of Contacts— Kickout spring provides force to open contacts.
 - *Trade Mark

- Provides Straight-through Wiring— Three line leads at top; three load leads at bottom.
- Provides Positive and Precise Overload Protection—Snap action bi-metal DISC instead of "solder pots" or bi-metal strips.
- Permits Front-removal of ALL Parts—No special tools required.
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- Meets NEMA Standard Mountings.
- Gives Quietest Operation—Self-aligning magnet construction.

See for yourself. Ask your Westinghouse representative to show you "the inside story"—a Trans-Vision presentation of the Life-Linestarter. Get the facts. Write for 20-page complete line booklet, B-4677. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



GREATER SAFETY AND FLIGHT REGULARIT AT IDLEWILD



HAZARD'S KEYSTONE-HAZAPRENE CABLE

Of the many important electrical advances made in airport lighting, power transmission and flight control at the New York International Airport, one of the most interesting is the "All Weather Guide Lights.

Designed to provide pilots with reliable visual guidance in adverse flying conditions, these high intensity approach and contact lights consist of 35 Blaze Units, 35 Flash Units - all controllable from the operational tower.

One of the insulated wire and cable requirements at Idlewild served by Hazard is the power supply to these vital lighting aids, and here Keystone-Hazaprene Cable is used.

For high voltage circuits, Hazard's Keystone insulation effectively combines in one oil base compound unusual resistance to ozone, heat, moisture, sunlight, chemicals and acids. Protected with a Hazaprene sheath (a Hazard-developed neoprene compound) - Keystone-Hazaprene Cable assures the long-lived, trouble-free service required from these lighting circuits.

In planning electrical wire and cable needs for modern airports, you'll find Hazard's engineering experience, outstanding insulations, and protective coverings will help you obtain the right answer to your particular operating conditions. For example, over twenty years field service under severe operating conditions has proved Hazasheath and Armortite Cable ideal for trouble-free, long-lived power transmission, communication and control circuits. Nonmetallic sheathed, these cables are light-weight, quick and easy to install . . . are buried direct or run in conduits. Whatever your need, you can rely on Hazard Insulated Wires and Cables for long, continuous, safe, trouble-free service. Our engineering service is available without obligation. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

High Intensity, Controllable, All Weather Guide Lights at New York International Airport, Idlewild, N. Y., installed by Hoffman and Elias. Flash and Blaze units alternate, with the Flash Units capable of developing 3 billion candlepower to assure pilots of visual contact with field through poorest weather conditions. Wire "feelers" on top of each light discourage seagulls from landing.

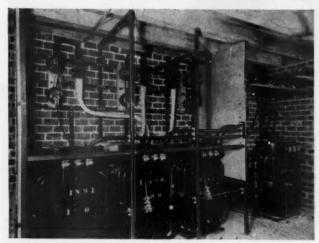




6883

insulated wires and cables for every electrical use

Practical Methods



FRAMING STRUCTURE of continuous channel Unistrut for transformer bank eliminates layout and drilling; provides maximum flexibility of adjustment for final alignment of switches and insulators to meet installation requirements.

Structural Framing In Transformer Vault

WIRIN

Installation ease was one feature of the structural framing used in a transformer vault at the new East Tennessee Baptist Hospital in Knoxville. Simplification and man-hour economy were effected by using continuous channel framing members (Unistrut) with flexible mounting features. Aside from inserts for floor and wall anchors, no drilling was required. The tedious job of accurate layout and drilling of holes for switches, insulators and associated equipment was entirely eliminated.

At the back of the transformer bank are four upright members anchored to the wall. These support a network of horizontal and vertical members spaced to accommodate primary cable terminals and disconnect switches. Similar uprights extend from floor to ceiling beams in front of the transformers; are strengthened by brackets fastened to the wall channels; have horizontal crossbraces at approximately transformer height. Secondary cables are racked in porcelain cable clamps mounted to the channel uprights. An overhead rack of Unistrut channel carries the secondary cables to the distribution board.

Biggest reported advantage of this technique, from the standpoint of elec-

trical equipment installation, is the fact that final adjustment and alignment of switches and insulators could be quickly made by simply loosening a few nuts, sliding the equipment along the continuous channel in the proper direction, then tightening the nuts. Mechanics adjusted these units to meet the contours of the established cable runs.

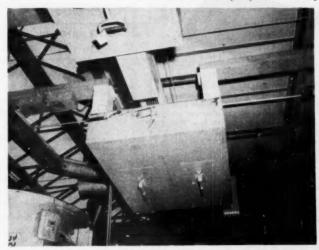
Messenger Supports Heavy Power Ducts

WIRING

When Ralph H. Decker, consulting electrical engineer of Chicago, designed the electrical distribution system for the Sola Electric Company plant in Chicago, he used 2,000-amp. and 1,000amp. LVD feeder bus duct to the point of load concentration and then continued and branched off with smaller capacity plug-in type of bus duct to serve the numerous machines. One installation problem arose. The duct runs, in a number of instances, were at right angles to the steel supporting members of the flat roof structure. Because of structural conditions, conventional hanger and bracket techniques could not be effectively used.

Decker's solution was the design of messenger cable supports for the power duct lines. A single messenger with eye-bolt hanger rods of required pre-cut length supports the distribution duct. A double messenger run, with similar rods as part of a trapeze hanger, carries the heavy feeder duct circuits. The messenger cables are drawn taut and fastened to the widely spaced heavy steel beams. Intermediate duct supports are provided by the messenger cable hangers.

At the point where the feeder duct is reduced in capacity and branch tap-



FUSIBLE ADAPTER SWITCHES provide tap-off for two 400-amp. branch duct runs from main 1,000-amp. feeder duct. Part of fusible duct reducer switch is in foreground.



"How many times do I have to tell you that INTERCHANGEABLE is another word for P&S-DESPARD?"

P. S. Slim must be new in the business. Veteran electricians and architects know all about the famous interchangeability of compact, modern, precision-built P&S-Despard wiring devices.



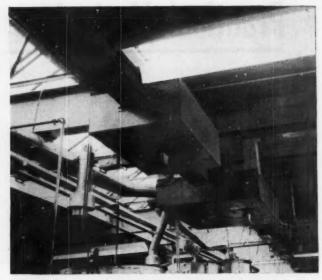


A switch, a pilot light and a convenience outlet — or any two or three devices of your own choosing — can be assembled into one gang combinations right on the job when you use the interchangeable P&S-DESPARD Line. P&S-Despard devices are the result of sixty years experience in the manufacture of precision-built wiring devices. They are sturdily built to give dependable service... are Underwriters' approved... meet or exceed all Federal and R.E.A. specifications... can be installed in a matter of seconds with the new Camstrop. As Tubby has said: "INTERCHANGEABLE is another word for P&S-DESPARD!"

PASS & SEYMOUR, Inc.

34 Boyd Ave. Syracuse 9, N. Y.

Maker of the famous P&S-Despard Line



LOAD DISTRIBUTION center on main 1,000-amp. feeder duct includes two 400-amp. tap-off switches in rear and 800-amp. duct reducer fusible switch in foreground.

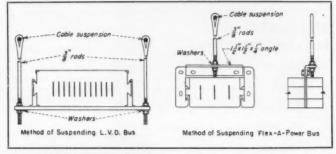


Fig. 1—CABLE SUSPENSION hanger details for feeder and distribution bus duct circuits.

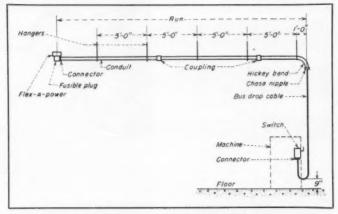


Fig. 2—LATERAL RUNS of bus drop cable are carried to machine location in conduit extensions supported by messenger or on steel structure as conditions permit.





... OR HOMES

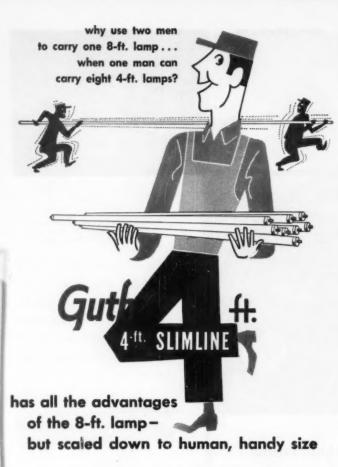
Neoprene-jacketed cable means economical, trouble-free service

Out in the open, neoprene-jacketed cable withstands sunlight, weather, ozone, heat and cold . . . resists chemical deterioration in industrial areas, oil and grease. It can stand scuffing and abrasion from trees; will not festoon. Underground, a tough, durable neoprene jacket offers protection against crushing and denting by settling earth. And it withstands the effects of acid and alkaline soil; or galvanic action, which is destructive to metal sheaths.

So make sure the cable you use is designed for long, trouble-free service—with a jacket of Du Pont neoprene. Although Du Pont does not make neoprene products, leading wire and cable manufacturers use neoprene for their quality constructions. Your distributor can supply you. And if you'd like to read about new neoprene applications that may help you, we'll put you on our mailing list for "The Neoprene Notebook." Write: E. I. du Pont de Nemours & Co. (Inc.), Rubber Chemicals Div. T-6, Wilmington 98, Del.



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IGHTING

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offs are made, fused adapter switches are installed. These units (size and bulk depending upon capacity) are suspended by four hook rods mounted to special channel-iron brackets that span the I-beams running parallel to the duct. In the attendant photopgraph, two 400-amp, bus duct branches are tapped to a 1,000-amp. feeder duct through an adapter switch containing two 400-amp., 240-volt, 3-pole, fused switches. The main duct continues as an 80-foot extension of 800-amp. plugin type duct. Reduction in carrying capacity is accomplished through an 800-amp., fused, reducer switch (in foreground of photo).

Bus drop cable connections to the individual machines are carried from the plug-in unit in lateral conduit extensions that terminate in a chase nipple bend over the machine location. Cable loop at the motor control drops to within nine inches from the floor to assure a vibration-free connection.

Electronic Smoke Control Guards Moving Stairways

- COMMERCIAL

Smoke detection equipment and a high capacity smoke exhaust system contribute to the protection of movingstair wellways in the Sage-Allen department store at Hartford, Connecticut, against fire damage and possible panic.

Developed jointly by Otis Elevator, Grinnell and Westinghouse, the system functions to prevent smoke and fumes from spreading throughout the build-



HIDDEN DUCT SYSTEM shows only the entrance to the exhaust intake duct that circles the canopy above moving stairway landings. It appears as a thin, dark line. One of the lateral ducts can be seen above the head of the model.

Monowatt Combines devices and plates

SWITCH, OUTLET and PILOT LIGHT COMBINATIONS

Cet. No. 4046—Pilot Light, Single Pole Switch, Outlet & Plate (illus.)

& Plote (liles,)
Cet. Ne. 4021—Single
Pole Swith, Outer & Flate,
Cet. Ne. 4224—Two Single
Pole Switches & Flete,
Cet. Ne. 4028—Single
Pole Switch, Three Way
Switch & Plote.
Cet. Ne. 4028—Single
Pole Switch, Pliot Light &
Plote
Flote
Flote
Flote
Flote
Flote

Cat. No. 4041-One Sin-

gle Pole Switch, Two Outlets & Plate.

Switches "T" rat 250V; 10A-125V 10A-250V; 15A-123/, Pi-lot Lights (6 watt lamp), 75W-125V, Meet Federal Specifications W-S-893, except for technicality Para E-12.0

Cat. No. 1321--"T" Rated Single Pole Switch & Plate, Cat. No. 1323-"T" Rated Three Way Switch & Plate. In Brown and in Ivory. 5A-250V; 10A-125V. Meet Federal Specifications W-S-896 except for technicality in Para. E-12°.

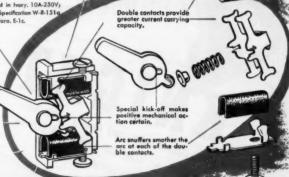
Cet. No. 1223-Triple Outlet & Plate. Double contacts of heavy spring bronze. Complete unit is less than $\frac{7}{8}$ deep . . . 'deal for shallow box installations. In Brown and in Ivory, 10A-250V; 15A-125V. Meet Federal Specification W-R-151g except for technicality in Para, E-1c,

* Requires a metal mounting strap. These devices are factory assembled on the plate to make a one-piece easy-toinstall unit

COST LESS TO BUY. You save about onefourth the cost of separate devices of equal quality . . . you get three outlets at less than the cost of two.

COST LESS TO INSTALL. (1) Just two screws mount the complete unit. (2) Combining plate with device makes flush mounting automatic . . . eliminates adjustments. (3) Oval screw holes give ample leeway for squaring. (4) Mounting screws already in position, ready to be screwed into outlet box.

GIVE A BETTER JOB. Smart and modern in appearance, these specification grade devices mean fewer call-backs, longer years of reliable service.





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MORE THAN A YEARS OF SERVICE TO CONTRACTORS AND JOBBERS



ELECTRONIC DETECTOR is 8-foot metal tube, 2½-inches in diameter with photoelectric cell at one end and a lamp in back of an optical system at the opposite end. When smoke concentration in tubes rises above safety point the exhaust system is placed in operation automatically.



CONTROL BOARD of the Kidde electronic smoke detector is adjusted by Sage-Allen's Chief Electrician, Stanley Wiggins, who explains function and operation of system to S-A Vice President, William Haine.

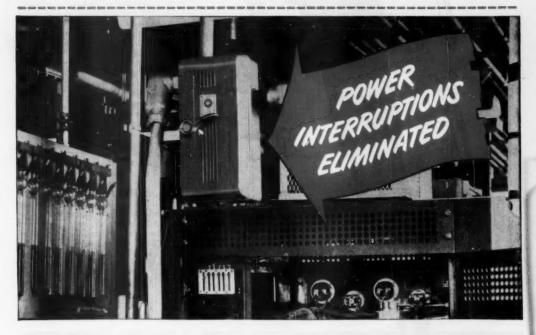
ing. This is accomplished through the integration of a detector system with an automatically controlled exhaust system,

The detector system in the Sage-Allen store, furnished by Walter Kidde, includes six air sampling accumulators or intake heads, a detector element or smoke tube and an exhaust fan on each protected floor. The main control panel includes relays, amplifiers and equipment required to convert signals received from the detectors into electrical impulses.

The exhaust system includes intake slots around the ceiling trim of each wellway, an exhaust flue and lateral ducts, a louvered penthouse directly above the wellway, a 32,000 cfm centrifugal type exhaust fan and a 25 hp

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Westinghouse



AB-I Breakers Save up to \$1500.00 Per Year

For a net cost of \$166.00 for five Westinghouse AB-I Circuit Breakers, Raytheon Mfg. Co., Newton, Mass., Radio Receiving Tube Division, reports savings that add up to many thousands of dollars per year.

Mr. Gordon Robertson, Raytheon Plant Engineer, reports that prior to installation of Westinghouse AB-I Breakers on their induction furnaces, they suffered substantial losses from power failure at least once a year. Each power failure, for each machine affected, cost between \$1,000.00 and \$1,500.00, due to loss of material in process and lost time pay.

Since installation of Westinghouse AB-I Breakers, they have eliminated these staggering losses.

This is typical of savings made possible by replacement of ordinary protective devices with Westinghouse AB-I Breakers. They are especially designed to protect insulated conductors from the effects of overcurrent and short circuit

—without the use of fuses. They permit momentary overloads, but trip instantly when a dangerous overload occurs. They permit quick resumption of service when the fault has been removed. Thus, unnecessary work stoppages are prevented, delays in restoring service are reduced.

Westinghouse AB-I Breakers offer special features not obtainable in similar protective devices, in a broad range of sizes and types. Get the facts. See your nearby Westinghouse representative, or write for Bulletin DB-30-230. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.





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two-speed motor for driving the fan.

This system supplements, not supplants, the conventional overhead sprinkler system.

The infiltration of smoke in the detector system reduces the intensity of light reaching the photocell in the smoke tube. When the intensity of light drops to a predetermined minimum due to concentrations of smoke in the air, the photocell activates a relay which automatically stops the movement of stairways, sounds an alarm in the boiler room, opens the lateral ducts on the floor where the fire is located, switches the exhaust fan motor to high speed, opens the fresh air intake damper on the roof, and flashes a light on the control panel to identify the location of the fire.

With stairways stopped, customers can get out of the fire area by walking down either the "up" or "down" stairways. Smoke and fumes are pulled from the area at a 14 mph clip and cold air is drawn down to help push the smoke into the exhaust intake slots.

Electrical signals report all breaks in the control system, the inoperative condition of any photoelectric cell, the failure of exhaust fans or fuses, the collection of dust on the optical elements of the detector or power failure. The installation is completely automatic and makes a positive contribution to department store safety.



AIR-COOLED TRANSFORMER rests on floor in range test section of Hotpoint's new Chicago range plant. Single-phase, 100-kva. (some 50-kva), 480/115/230-volt unit is rigidly positioned by channeliron floor guides with spacer plates; provides constant voltage for range test only. Disconnect and distribution panel are supported by 3½-in, channel-iron A-frame. Pull box under panel accommodates primary feeder and secondary underfloor circuits to test panels and conveyors. Installation by Sweningson & Company, Chicago electrical contractors on the project.



meet the newest member

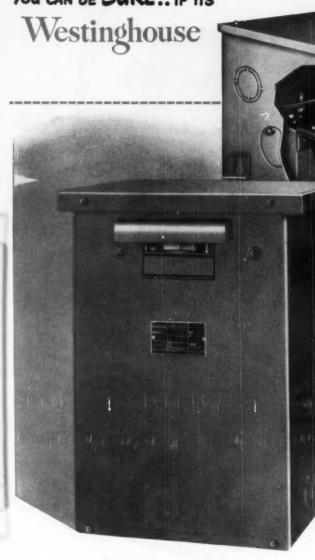
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TRIPLE

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LOW MAINTENANCE COST: Dry-type construction is recognized as the "minimum maintenance" transformer design.

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Strong Domed Covers are warped and Body Cover Joints are ground flat for tight gasket seal. Heavy hub sections of ample cross section are tapped straight and true with accurate, cleancut, TAPERED threads.



Dowl-pin type self retaining screws provide easy alignment of covers—hold cover and gasket together during handling.











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- 5. CAST METAL SAFETY SWITCHES AND CIRCUIT BREAKER PYLETS—Heavy duty safety switches and fuse boxes with or without plug receptacles and circuit breaker Pylets with all features for reliable service under severe conditions. Safety switches have quick make and break, interlocked cover and weathertight gaskets on both cover and hub plates. Available with interlocking plug receptacles.

Refer to your Pylet Catalog 1100 for complete listings including plugs and receptacles—explosion-proof pylets, cord and cable grips—flexible conduit couplings—unions—reducers—elbows and grip handles—portable hand lamps.

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Industrial Electrification

Induction Motors in Industry—Part II

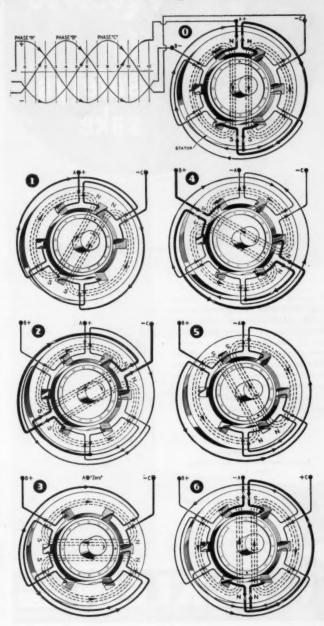
By G. L. Oscarson Chief Applications Engineer Electric Machinery Manufacturing Company

AGNETIC LINES OF FORCE (commonly called flux) surround any conductor carrying current. This results in a magnetic field of definite strength depending on the amount of current flowing in the conductor and the nature of the magnetic circuit, that is the iron path available for flux adjacent to the conductor. The magnetic field has a definite polarity depending on the direction of current. Thus, the magnetic field surrounding a conductor carrying alternating current varies both in strength and direction. It pulsates, at line frequency, from maximum in one direction to maximum in the opposite direction. For explanatory purpose consider a two-pole motor with 6 stator slots. (Fig. 8.)

If twelve conductors, properly connected, are placed in the six equally spaced slots on the inner periphery of a laminated steel ring (called a stator) and are connected to a 3-phase supply, they will produce, in effect, a rotating magnetic field. The magnetic field will be substantially uniform in total strength, but will rotate in space as described later.

As the alternating currents change in value and direction, the magnetic field, in effect, rotates clockwise about the stator; the lines of force thus cutting across the squirrel-cage bars in the rotating element (called a rotor). These bars are all electrical

FIG. 8-How 3-phase ac produces the rotating magnetism that spins the rotor is diagrammed above. This shows the disposition of electric currents and magnetic field of the stator of a 2-pole induction motor for regular intervals (0 to 6) comprising ½ cycle of the ac waves. As the ac changes in strength and direction the magnetic field rotates around the stator. The poles of the rotor, induced by lines of flux cutting across the squirrel-cage bars, are forced, by magnetic attraction, to follow the rotation of the stator poles. Diagrams 0 to 6 correspond to numbered positions in phase plot of 3-wave ac which operates induction motor.





BELMONT

conductors and are connected by shortcircuiting rings. The magnetic lines of force that are represented by the dash lines may be assumed to pass through the air-gap at right angles to the face of the rotor.

As long as the rotor remains stationary the motor is, for all practical purposes, a transformer with a short-circuited secondary winding. The rotor bars constitute the secondary. Currents of considerable magnitude, alternating at line frequency, flow in these bars. They are induced by the magnetic lines of force cutting across the bars. As is well known, a conductor in a magnetic field and carrying current will have exerted on it a force tending to move it at right angles to the magnetic field. A tangential force, or torque, is thus exerted on the rotor periphery.

The direction of this torque causes the rotor to attempt to turn the same direction that the magnetic field in the stator is rotating; in this case clockwise. The amount of torque developed depends on the power consumed as resistance losses in the cage bars of the rotor, that is it depends on

the I'R losses.

If the torque developed causes the rotor to turn, it will accelerate to some definite speed at which the turning effort is equal to the retarding effort or load.

If very little load is imposed, say only friction and windage of the rotor, only a slight amount of current need flow in the squirrel-cage bars to develop that torque. Only a very slight amount of relative motion (slip) between the rotating magnetic field and the rotor is required to induce this amount of current. The rotor will therefore turn at nearly synchronous speed at no load.

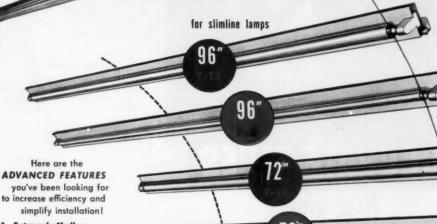
However, even to overcome only friction and windage some definite torque is required. To develop this there must be some current inducted in the rotor bars, however slight. This necessitates some slip even at no load and therefore synchronous speed cannot quite ever be reached.

By reversing any two of the leads of a 3-phase motor, the phase rotation will be reversed. This would cause the magnetic field to build up to reverse order and to rotate counter-clockwise.

Synchronous Speed, as stated previously, varies inversely as the number of stator poles. Stator windings can be arranged to have 2, 4, 6, or any other practicable number of poles in multiples of two.

Torque. Torque, in percent of full-load torque, is plotted against speed. (Fig. 9)

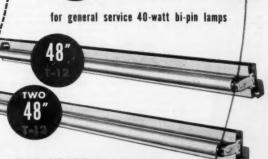
In this case, the locked-rotor torque is 125% of full-load torque. It rises to



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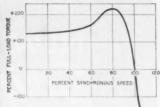


FIG. 9—Typical torque curve showing operation both as induction motor and as an induction generator.

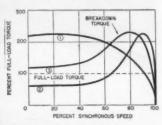


Fig. 10—Torque of induction motor varies with resistance and reactance of cage bars, shown by 1, 2 and 3 above.

225% at approximately 85% speed, and drops to 100% at 98% speed (2% slip). At synchronous speed, zero torque is developed, as has previously been mentioned. If the rotor is driven above synchronous speed, it will continue to draw a magnetizing current component from the line but will deliver a power component. It will therefore operate as an induction generator, delivering full load at normal full-load slip (in this case a negative slip).

The locked-rotor torque, full-load slip and locked-rotor kva. of any squirrel-cage motor will vary widely with changes of resistance in the rotor winding. The breakdown torque will however remain substantially the same. As stated previously, a squirrel-cage motor has many of the characteristics of a transformer. A high-resistance secondary (rotor winding) results in a relatively low locked-rotor kva. A low-resistance rotor results in a high locked-rotor kva.

Torque is maximum when the resistance and inductive reactance are equal. But inductive reactance increases with frequency and will be high with locked-rotor conditions. To develop high starting torques the rotor resistance must therefore also be high and locked-rotor kva. will be relatively low. This is illustrated by curve 1, Fig. 10. Such a motor would have a high slip, a high slip loss and consequently a low efficiency, and would not be suitable for continuous full-load operation, except in very rare



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If this rotor is replaced by one with a very low resistance winding, the maximum torque must be obtained at a point where inductive reactance is also low, possibly at 10% slip. This is illustrated by Curve 2. Due to the low resistance winding, the locked-rotor kva. will be high. The efficiency and full load speed will be high.

Starting torque will be extremely low due to the fact that rotor currents will be relatively low at standstill, being limited by inductive reactance in spite of the low resistance. But torque is equal to I*R and since the resistance is low, the torque will be low.

However, at operating speed (2% slip or 1.2 cycles per second on a 60 cycle system) the inductive reactance is low and the low stator resistance permits such a large current to flow that full-load torque is developed at very low slip. Due to the low starting torque, this design motor is not universally acceptable.

A suitable compromise is a motor with a cage of normal design having characteristics as in Curve 3. This has adequate locked rotor torque for most applications, low starting kva. and still has low slip and high efficiency.

Double-Cage and Deep-Bar Rotors
—Where good locked-rotor torque, low
slip characteristics and low lockedrotor current are desired, a doublecage rotor is frequently used (Fig. 11).

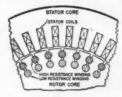


FIG. 11—Double cage rotor. Shallow high-resistance upper bars provide high starting torque. Deep, low-resistance bars give high efficiency low slip running torque.

The current in the low resistance lower cage bars is effectively limited by high inductive reactance at standstill. The inductive reactance is high on account of the large amount of iron in the magnetic circuit adjacent to these bars. The low-resistance lower cage winding is therefore quite ineffective. The upper cage, however, has low reactance and high resistance and this results in high locked-rotor torque and moderate starting current.

At operating speed the inductive reactance of the low-resistance winding is low due to the low slip frequency. Most of the induced current then flows in the low resistance winding resulting in low slip and high efficiency.

Frequently, deep rectangular bars are used (Fig. 12). This approximates

why there can be

NO OTHER ANSWER IN SAFETY SWITCH SELECTION

Engineering research authenticated by outstanding authorities has conclusively established "internal heating" to be the principal cause of safety switch failures. This "internal heating" literally bakes the life right out of safety switch parts, causing insulating materials to disintegrate and metal parts to distort and corrode. The safety switch then either becomes inoperative or it "burns up" through inability to carry the load.

In properly constructed safety switches, fuses are almost entirely responsible for this destructive "internal heating." This is not a criticism of fuses for any fuse operating up to its rated load must be near its melting point if it is to perform properly when an overload

occurs. And any metal operating near its melting point must be hot . . . and fuse links are hot . . . with temperatures running as high as 700 degrees Fahrenheit.

Since you cannot vent trapped heated air through a safety switch enclosure and still keep a safety switch safe, the only escape from the ravages of "internal heating" must come through the selection of materials for the internal safety switch structure and the design of that structure to withstand successfully the unavoidable heat conditions met in safety switch service.

Cutler-Hammer Safety Switches were completely redesigned in this way ten years ago to beat "internal heating" when engineering research clearly indicated the need for such safety switches. Nine years of experience shows the Cutler-Hammer claim of better safety switch performance far more than a mere promise; it is a proven fact that demonstrates why there can be no other answer in safety switch selection. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.



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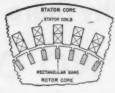


FIG. 12—Deep-bar rotor. Approximates the performance of the double-cage rotor and has distinct advantage that large area is available for heat dissipation when starting.

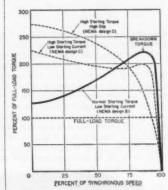


FIG. 13—Typical torque curves for NEMA Class B, C and D induction motors.

the performance of a double-cage rotor. It has the distinct advantage that the full area of the bar is effective for heat dissipation during starting and acceleration. The shallow, upper-cage, high-resistance bars of a double-cage winding are susceptible to damage on loads having a long accelerating time. This is due to concentration of the current in only the shallow upper cage windings at relatively low speeds.

Squirrel-Cage Motors

The great majority of squirrel-cage induction motors are used for a relatively few applications. To obtain some uniformity in application NEMA has designated specific designs or classes of motors, having specified locked-rotor torque, breakdown torque, slip, starting current, or other values. The more common ones are Classes B, C and D.

NEMA Class B (Normal Starting Torque, Low Starting Current) are the most widely used of all types of squirrel-cage motors. They have locked rotor torques adequate for starting a wide variety of industrial machines and drives and a starting current, on full voltage, usually acceptable to power systems. (Fig. 13)

NEMA Class C (High Starting Torque, Low Starting Current)-

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CRESCENT SYNTHOL—Type TW, Building Wires and Cables are insulated with a special, tough, thermoplastic compound that results in wires of unexcelled Permanence, Safety, Adaptability and Value. They combine high dielectric and mechanical strength with the following desirable features.

SMALL DIAMETER—has smallest outside diameter for same conductor size, permitting more conductors, or larger conductors in same space.

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RESISTANT to moisture, acids, alkali and most chemical solvents.

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BRIGHT COLORS—non fading, the insulation is the same color throughout so color will not scrape off; easily cleaned twelve colors.

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Motors have high locked-rotor torques, low starting current and relatively high full-load slip. Class C motors are usually designed with a locked-rotor torque of over 200% and a breakdown torque of not less than 195%. The slip at full load in the usual range of horsepower ratings will be 1½% to 3%.

NEMA Class D (High Starting Torque—Low Starting Curreat—High Slip) Motors use a high-resistance rotor and are commonly used on loads having high intermittent peaks. The driven machines are usually provided with a flywheel having considerable Wk.*. At no-load the motor operates with very little slip. When the peak load is applied the motor slip increases appreciably, permitting the unit to absorb energy from the flywheel. This reduces the power peaks supplied by the electrical system, resulting in a more uniform power requirement.

Class D motors may be used with Punch Presses, Reciprocating Pumps, Chippers, etc.

Chippers, etc. 2-Pole Motors (3600 synchronous rpm. at 60 cycles, 3000 synchronous rpm. at 50 cycles).—To obtain low starting current, 3600 rpm. and 3000 rpm., Class B motors usually have low locked-rotor torque and low accelerating torque. A typical torque curve for such a motor is shown in Fig. 14.

The lower dotted curve illustrates the torques required by centrifugal pumps or centrifugal compressors with closed discharge. The upper dotted curve illustrates torque requirement with open discharge. These curves show that such units must always be started unloaded, and full line voltage must be maintained. If during a period of low voltage the motor should drop down to about 60% speed, it might not be able to accelerate to full speed on full voltage unless again unloaded.

NEMA has Code Letters representing starting conditions on full voltage.

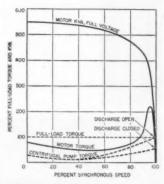


FIG. 14—Typical speed-torque curve for NEMA Class B, 3600 rpm squirrel-cage motor.

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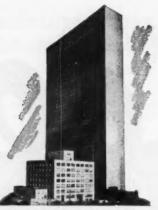
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Architects: Harrison and Abramovitz * Engineers: Syska and Hennessy, Inc. * General Contractors: Fuller-Turn-Walsh-Slattery, Inc. * Electrical Contractors: Fischbach and Moore, Inc.



METROPOLITAN LIFE INSURANCE CO.—72,000 feet of G-E Fiberduct underfloor raceways.

Architect: A. O. Angilly • Engineers: Meyer, Strong, and Jones • General Contractors: Starrett Bros. and Eken, Inc. • Electrical Contractors: Lord Electric Co., Inc.



crowell-collier building — a 35,000-foot over-all Fiberduct raceway pattern.

Architects: Leonard Schultze and Associates: Walker and Poor « Consulting Engineers: Edward E. Ashley, Inc. « General Contractors: Starrett Bros. and Eken, Inc. « Electrical Contractors: L. K. Comstock and Co., Inc.



THE MUTUAL LIFE BUILDING—a 99,000-foot G-E Fiberduct installation.

Architects: Shreve, Lamb, and Harmon Associates Engineess: Jaros, Baum and Bolles • Electrical Engineess: Clark, MacMullen, and Reiley • General Contractors: Turner Construction Co. • Electrical Contractors: Lord Electric Co., Inc.

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General Electric Fiberduct raceways make it a simple matter to install additional outlets at all times. It is only necessary to make a small opening in the floor over the raceway, to pull the wires through, and to install the outlet. New distribution is provided by merely pulling additional wires through the raceway. There's no interruption of building facilities . . . no annoyance to building tenants!

Complete specifications and installation data are available from your General Electric Construction Materials distributor. For a free copy of the G-E Fiberduct Data Manual, write to Section C4-618, Construction Materials Department, General Electric Company, Bridgeport 2, Conn.



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Product News



Switch Box (1

A new work, insulated switch box, No. 7050-C has been announced. No supporting straps required-conveniently mounted to side of studding. Sharpened tips on bracket permit temporary positioning on studding before nailing. Bracket so constructed and mounted to box to insure rigidity and support. Two knockouts in each side and end, one knockout in bottom. Tapped top holes on centers to accommodate all standard receptacles, switches, etc. Height, overall 21 inches; length 4 3/16 inches outside ears; width 2 inches. Listed by Underwriters' Laboratories, Inc.

Union Insulating Company, Inc., Parkersburg, W. Va.

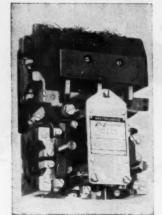


Tester (2

A new constant-voltage Megger insulation tester has been announced. It has all the advantages of the Midget Megger tester, plus a new improved generator, flush terminals and moderndesign plastic case. It is available with ohm scale and selector switch in ranges

0 to 10 megohms (100 volts), 0 to 20 megohms (250 volts) and 0 to 50 megohms (500 volts). For uses by electrical contractors, inspection work and in industrial plants. Constant-voltage feature becomes important as a source of steady dc test voltage. Slip clutch or centrifugal governor built into driving mechanism permits cranking at varying speeds without effect on the voltage output of instrument.

James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.



Starter (

A new ac magnetic, non-reversing De-ion Life-Linestarter is available. Designed for either across-the-line starting of squirrel cage induction motors, or as a primary switch for wound motor induction motors, it provides complete protection of motor, machine and operator. Starter has only one moving part, a "see-saw" lever balanced on a knife-edge bearing or center fulcrum. Insulating parts of coldmolded inorganic material will not carbonize and are shock-resistant. Available in NEMA size 0 through 4, it can be applied to all integral horsepower motors up to 100 hp. It is supplied in standard ac voltage ratings from 110 to 600 volts at frequencies of 60, 50 and 25 cycles, for three-phase, two-phase four wire, and single-phase operation. Up to four electrical interlocks are available for any combination of normally open or normally closed operation.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.



Swivel Connector

(4)

A new swivel connector, designed to permit electrical connections to rotate freely and continuously, right or left, without interruption of current flow or contact has been announced. Swivel is a connector which can be locked in position and which houses a continuous electrical circular contact, male and female. It is made in various shapes and sizes and standard threads for two, three or four wire circuits. Units are made of aluminum, cold rolled steel, stainless steel, naval brass, commercial brass, bronze or any specified metal. Approved by Underwriters' Laboratories.

Remcraft Products, Cleveland, Ohio,





RECESSED TROFFERS, known as "Lite-Blox", are available from Edwin F. Guth Company, 2615 Washington Avenue, St. Louis 3, Mo. Many combinations offered in this line are derived from a basic unit. One cross section is used for all lengths of Lite-Blox; one basic unit used for 1, 2, 3 or 4-lite sizes. Flange type troffers can be converted to teebar types. Available in both deep and shallow with flange and teebar mounting edges for 20, 40 and 85 watt lamps for 60 inch T-17 low brightness lamps and for 4 ft., 6 ft. and 8 ft. slimline lamps.

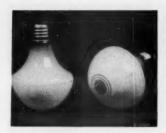


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(6) Lamp

A new type of incandescent lamp, looking somewhat like an inverted mushroom, has been designed for ceiling fixtures in which bare bulbs are used in a base-up position. Employing this unique shape and an enamel finish for diffusion and decoration, the lamp forms a combined light source and fixture in a single unit. At present, only one size is available: a 50-watt lamp, measuring 3½ inches in diameter at the widest point, designated 50GA. Lower portion of bulb is covered with a soft-toned permanent enamel finish.

General Electric Company, Nela Park, Cleveland, Ohio.



Time Switch

A new electronic time switch for interval timing, time delay, repeat cycling, and programming has been announced. These plus variations, are available by changing external connections to terminal board. Timing periods of 1/20th second to four minutes with an accuracy variation of less than plus or minus 2% is accomplished by means of a selector switch and intermediate time variable resistor. Although supplied in a housing of heavy gage construction, same unit may be obtained without housing, or as a panel mounted unit. Standard units are supplied for operation on either 115 volt or 230 volt, 50-60 cycles. All relay contacts are rated at 10 amperes to 115 volt ac, 5 amperes to 230 volt ac, non-inductive load.

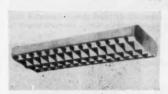
Coral Designs, a division of Henry G. Dietz Co., Forest Hills, N. Y.

Gravity Feed Oilers

Announcement has been made of gravity feed oilers with new ratchet control. Oilers automatically supply a measured amount of lubricant to plain, stationary and anti-friction bearings. Ratchet control provides instant adjustment of oil feed. Spring mechanism locks adjustment into position, avoiding danger of changing rate of feed while handling or cleaning, from vibration, etc. Protecting cap shields mechanism from dust and dirt. Oil supply is visible through shatterproof, reinforced plastic reservoir. Available in 1, 2, 4 and 8 oz. capacities; 1, 1 and in. pipe thread.

(8)

Trico Fuse Mfg. Co., 2948 North 5th St., Milwaukee 12, Wis.



FLUORESCENT fixtures, "Sun-Lite" series, especially designed for schools, stores, offices and institutions has been announced by Modern Light & Equipment Co., 3812 S. Wabash Ave., Chicago 15, III. Equipped for suspended or ceiling mounting and in continuous row. Available in 48 inch fluorescent for two or four 40 watt lamps; 48 inch, 72 inch and 96 inch slimline for two or four lamps.

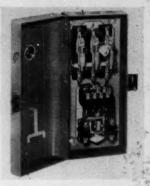


Conduit Clamp

(7)

A new "U" boltless pipe fastening device, adapted for mounting heavy wall conduit on standard angle or channel steel members, has been announced. Made of special steel, clamp is formed with ends shaped like wedges, clamping arch is designed to allow for variations in thickness, and to provide spring tension to anchor conduit. Available in type 3-B, used on 13 inch leg member, from 3 to 3 inch

Spedon Pipe Clamp Co., 41-29 63rd Street, Woodside, L. I., N. Y.



Magnetic Starters

Announcement has been made of newly designed Bulletin 4120 ac combination starters with disconnect switches, fusible and non-fusible type. They are for industrial and commercial use where a magnetic full voltage starter coupled with disconnect means at starter location is preferred over separately mounted components. Starters with fusible disconnect switches fulfill N.E.C. requirements for motor branch circuit over-current protection, disconnecting means, motor running over-current protection and motor starter. Non-fusible starters meet these same requirements except for motor branch circuit protection. Starters feature front operation, thermal overload protection, high arc interruption capacity. Available in four standard sizes to 50 hp., 3 phase, 550 volt, 60 cycle max.

Ward Leonard Electric Co., Mount Vernon, N. Y.

Color Television

(12)

A high-definition, high-fidelity color television system has been made available to industry as a packaged, readyto-operate unit. It is known as Type TA-164A industrial telecolor system and is an adaptation of the DuMont Image-orthicon chain. Using directwire circuits, the bandwidth has been increased to 18 mc to provide for 525 lines at 180 field per second. Pictures are viewed on 12½ inch screens in true colors. Equipment is offered as a complete system with camera, connecting units and viewing monitor. Many and varied uses are anticipated in the merchandising, medical, factory-management, research and educational fields for this commercial TV color system. Through addition of more cameras and viewing monitors, the uses may be multiplied many times.

Allen B. DuMont Laboratories, Inc., 1000 Main Ave., Clifton, N. J.



VOICE ALONE SUPPLIES THE POWER for this mine communication system insulated with 'SCOTCH" No. 33 Electrical Tape. Precision-built magnetic circuit converts sound to electrical impulses.

"Sound-powered" mine telephone now insulated with plastic tape

"Sound powered" telephones that require no plug-in to electric power, meet rigid mining industry specifications for well insulated instruments, thanks to "SCOTCH" No. 33 Electrical Tape with plastic backing.

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STATION BOX wiring is protected against shock, vibration, water, and corrosive gases with "SCOTCH" corrosive gases with No. 33 Electrical Tape.



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Surfacing, "JM" Abrasives, "JM" Adhesives.

General Export: DUREX ABRASIVES CORP, New Rochelle, N. Y.
In Canada: CANADIAN DUREX ABRASIVES CORP, New Rochelle, N. Y.



Hand Torch

Announcement has been made of a new PREOP hand torch. It features a throw-away, beer-can sized, fuel container, weighs 24 ounces; lights instantly without pouring, priming or pumping; produces a blue 2,200-degree flame in less than a minute. The fuel, a blend of liquid petroleum hydrocarbons, is self-pressurizing, self vaporizing, non-toxic, non-poisonous and operates at low pressure. Unit has two interchangeable burners-a small one producing a long concentrating flame for small conductor soldering, and a larger one for large cables and sweating on lugs. Can also be used for silver soldering and

Appleton Electric Company, 1701 Wellington Ave., Chicago 13, Ill.

(14)



INCANDESCENT luminaire, called "Sno-Flake" has been announced by Curtis Lighting, Inc., 6135 West 65th Street, Chicago 38. Utilizing either 300 or 500 watt silvered bowl lamp, it is for use in schools, offices, stores and other commercial interiors. Onepiece die-cast aluminum louver is open top and bottom and finished baked white "Fluracite".



Knockout Plugs

(15)

New knockout plugs of positive snap-action design provide simple means for accomplishing permanent closure of unused knockout holes in electrical device or outlet boxes. New plugs are fabricated from heavy gauge stamped steel, and are cadmium plated to resist corrosion. Design assures a secure engagement which prevents loosening or accidental removal from knockout holes. Available in sizes to fit all five standard knockouts: ½ in., 1 in., 1 in., 11 in. and 11 in. Adaptable to other electrical and non-electrical uses, wherever either temporary or permanent plugging of fractional size holes may be required.

Buchanan Electrical Products Corp., 1290 Central Ave., Hillside, N. J.



Phase Sequence Indicator (16

A portable phase sequence indicator, designated as K-3, has been announced. It is built for use on 60 to 600 volt circuits. It can be used for checking phase sequence of circuits having a frequency above the normal 60 cycles by raising the minimum circuit voltage above 60 volts, the maximum frequently being 400 cycles. It can be used in connection with the wiring, installing and testing of polyphase circuits and apparatus. To determine the phase sequence, whether A-B-C or C-B-A, it is only necessary to clip on the leads, push the button, and see the direction of disc rotation.

Electrical Facilities Inc., 4232 Holden St., Oakland 8, Calif.



"Heads it goes where it belongs; tails . . . where the blueprint shows it."

P.S. OK, Fatso, have it your way. But wherever you put that device, make sure it's a P&S-- and no coin-flipping about it! Because with P&S quality, dependability and easy installation you've got a winner every time!

here's the new Pas-DESPARD flush neon pilot light

Here's a new unit in the famous interchangeable P&S-Despard Line. The 1/25 watt neon lamp gives off no heat, stays cold, is economical to



P&S

Catalog No. 1375

(available at all P&S Distributors)

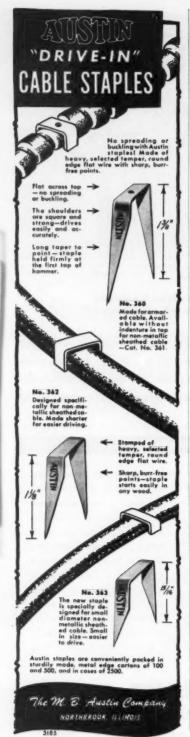
operate . . . sturdy all-bakelite body . . . binding screws have large heads, wiring is quick and easy . . . permanent, prismatic Plexiglas jewel is unbreakable . . . provides a neat, flush installation as a single unit or in all combinations. Approved by Underwriters' Laboratories. Order today from your regular P&S Distributor: No. 1375, brown; No. 1475, ivory.

PASS & SEYMOUR, Inc.

34 Boyd Ave. Syracuse 9, New York

Maker of the famous P&S-Despard Line







Motor Control

(17)

New "Slipsyn" full- or reducedvoltage synchronous motor control units, for operating and protecting all types of synchronous motor drives, are available. They are supplied as factory-wired units, requiring only external connections when installed. A new type ASR polarized slip-frequency relay, with associated control, provides automatic synchronization with maximum pull-in torque at the proper speed and phase relation. Pull-out protection is incorporated to stop the motor automatically if it pulls out of step. Provision for re-synchronization of motor after pull-out can be made if desired, and if load conditions permit, One thermal protective relay guards stator against sustained overloads; another guards rotor damper windings against failure of motor to start. Time delays under-voltage protection can be supplied on all models. With optional type BAL fuses, units have interrupting capacities up to 250,000 kva, 4,800 volts, three phase, 60 cycles.

Westinghouse Electric Corp., Pittsburgh 30, Pa.



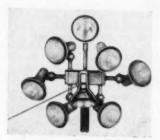
Relay (18)

Announcement has been made of a new motor control accessory, designed for use with a separate motor starter and pushbutton station to provide automatic restarting of motor after momentary voltage fluctuation or power failure of a few seconds duration. If power failure is prolonged

more than a few seconds, relay circuit "times out", disconnecting motor from line, thereby protecting operators and machinery from unexpected restarting of motor upon restoration of power, Automatic restarting is assured if voltage returns to 85% of normal within the time for which the device is set. It can be adjusted to give approximately 2 seconds or 4 seconds time delay. Time delay low voltage release devices are available in NEMA Type I general purpose enclosures or in NEMA Type VII explosion-proof enclosures for Class I Group D hazardous locations. They can be used with a suitable motor starter for control of ac motors rated up to 200 hp.

Square D Company, 4041 N. Richards Street, Milwankee 12, Wis.

(19)



FLOODLIGHTS AND SPOTLIGHTS designed to offer advantages of sealed beam lighting for outdoor use. They are obtainable in assemblies of 1 to 8 lamp holders. The line of all-weather units is made of cast silicon aluminum features complete lamp protection, air cooled operation, and 360 degree utility. Approved by Underwriters Laboratories. Standard base 75 and 150 watt PARS lamps as well as the R 40 (200 and 300 watt) lamps may be used. Manufactured by Magni-Lite, Inc., 60 East 42d Street, New York 17, N. Y.

Electrical Tape (20)

No. 163 electrical tape is now available in either 60 ft. or 824 ft. rolls, in. in width, in bulk, individual cartons or a 10-roll job pack, which contains 600 ft. Manufacturer states that it exceeds ASTM friction tape specifications eight ways: higher dielectric strength, better moisture barrier, less bulk with equal strength, sticks quicker, stays cleaner, unwinds easily, doesn't fray and sticks firmly to any clean surface. Polyken is manufactured by a calendering process and is not a friction tape, and black cloth backing is non-sticky.

Polyken Industrial Tape, 222 W. Adams Street, Chicago 6, Ill.

BIDDLE

Instrument News_

. ELECTRICAL TESTING INSTRUMENTS

. SPEED MEASURING INSTRUMENTS

. LABORATORY & SCIENTIFIC EQUIPMENT

NUMBER 1 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

A NEW CONSTANT-VOLTAGE TYPE MEGGER® INSULATION TESTER IN LOW-PRICED RANGE

The trim, modern design of this newcomer to the Megger family of insulation resistance testing instruments is only part of the story. Ohm scale and selector switch are available on all instruments in ranges of 0 to 10 megohms, 100 volts d-c, 0 to 20 megohms, 250 volts d-c, 0 to 50 megohms, 500 volts d-c. The constant-voltage feature is standard with all of these new CVM (Constant



Voltage Type Megger) Insulation Testers. These features plus several other mechanical refinements contribute to make this instrument a worthy addition to the popular line of Megger Instruments.

Bulletin 21-80-ECM, describing this instrument, will be sent on request. Check the coupon below.

UP TO 50,000 MEGOHMS WITH NEW MEGGER® INSULATION TESTER

New Higher Ranges Wider Ranges Longer Scales Improved Mechanical Features

Never before has the direct-indicating cross-coil ohmmeter been capable of measuring such high values of insulation resistance!

This accomplishment comes at a time when more attention than ever is being focused by engineers on insulation resistance or d-c loss measurements as a practical non-destructive means of forestalling breakdown in electrical equipment.

These new sets include also several important improvements, such as static shielding, improved hand-drive mechanism, and a simplified design for motor-drive with better voltage stabilization.

The new line of Megger Insulation Testers is now available in the following ranges:

0	Inner Scale Outer Scale		
Volts	Megohms	Megohms	
500 volts d-c	0 to 50	3 to 10,000	
		6 to 20,000	
2500 volts d-c	0 to 200	15 to 50,000	
For description	on and pric	es, write for	
Bulletin 21-20	D-ECM, Che	eck coupon.	



THE T-21 MEASURES SPEED SIMPLY BY TOUCH — OR BY MOUNTING ON MACHINE

This new low-priced, miniature FRAHM® Resonant Reed Tachometer is available singly or in kits of three instruments; for hand use or permanent mounting; in ranges from 900 to 13,000 rpm, higher ranges on request.

The T-21 has the advantage of being small and easy to use as a pocket or tool kit instrument and yet easy to read when mounted on a machine. It has

no parts to wear out, needs no maintenance, imposes no load on the machine under test, nor can it be damaged by overspeeding.

e machine unr test, nor can
be damaged by
rerspeeding.
The simplicity

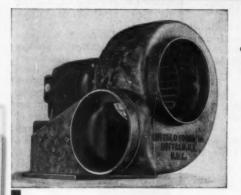
of this resonant reed instrument in no way affects its accuracy—Frahm Tachometers are guaranteed to within 0.5% of their rated frequency of vibration.

For full details on the T-21 Frahm Tachometer, write for Bulletin 31-35-ECM or check coupon below.

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ALWAYS GOOD SELLERS AND GOOD PERFORMERS



Buffalo

BABY VENT SETS

Rugged, compact and portable, they fit in almost anywhere for duct-mounted or free air delivery. These blowers—exhausters have adjustable discharge position and reversible rotation. Housing is cast iron, rotor is efficient, multiblade type. Ideal for removing gas, moisture, steam, smoke, odors from small areas. WRITE FOR BULLETIN 3222-F



BREEZO FANS

Very popular "package" units for exhausting vapors, fumes and gases. Sizes 12" to 36" for as high as 7300 cim. at ¼" static. Light, simple to install.

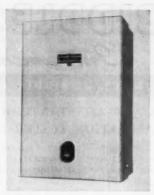
Motor is protected from air stream. Note handy inspection door. Fan is rugged Breezo type, built to last. WRITE FOR BULLETIN 3222-F, and prices.



ORGE COMPANY

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Branch Offices in All Principal Cities

PANEL BREEZO FANS BELTED VENT SETS BELT-AIR FANS BREEZ-AIR ATTIC FANS "L" BREEZO FANS "NV" BREEZO FANS



Motor Starter

(21)

Announcement has been made of a new motor starter for roving and spinning frames for the textile industry. Motor is started at slow speed, obtained by means of resistor in motor circuit. After a short time interval. when machine is under way, resistor is cut out of circuit to apply full voltage to motor. Thirty resistor taps allow adjustment of starting torque to meet specific conditions of the machine. Timing relay is adjustable over a wide range. Some advantages proven are reducing broken ends on starting; shortening time for piecing and doffing; more accurate overload protec-

Cutler-Hammer, Inc., 315 N. 12th Street, Milwaukee, 1, Wis.

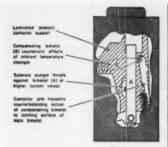


Conduit Entrance Cap

(22)

Announcement has been made of an addition of a conduit entrance cap to this line. The lightweight cap is made of a special high strength alloy which is non-corrosive. Cap is easy to position and an adequate number of holes are provided in the insulator. Cap holes and screws are filister head and all threads are clean and full cut. Sizes are marked on cap.

Blackhawk Industries, Dubuque,



Pushbutton Switching

Announcement has been made of ambient compensating feature of thermal-magnetic pushmatics, by which the full rated load of the device can always be carried and tripping characteristics will remain constant regardless of temperature variables. The calibration of pushmatics, which governs the speed and over-current values at which they trip, is not affected by air temperature, but remains constant at any temperature from 30°F to 150°F. Constant tripping characteristics are obtained by the use of two bi-metals instead of one. They are designed for use in Bull-Dog electri-centers and are Underwriters' Approved at 15, 20, 30, 40 and 50 amperes, 1 pole, 120 volts, or 2 poles, 120-240 volts ac.

BullDog Electric Products Co., Detroit 32, Michigan.

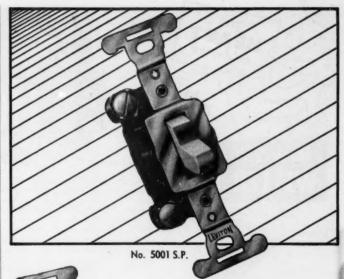


(24)

Soldering Tool

A new "Standard" 1,000 watt thermo-grip soldering tool has been announced. There is no pre-heating as touching the work with the tool couples the secondary power circuit, and heating begins instantly. It concentrates heat at the point of contact, heats only part to be soldered. Attachments available for handling all types of work include: "Plier" for sweating and unsweating copper tubing, soldering lugs, terminals and other work of that type; "Fork" with two 3 inch electrodes for reaching into restricted places; and "Pencil" with one 3 inch electrode.

Ideal Industries, Inc., Sycamore, Ill.



LEVITON DEVICES

for good reason . . .

preferred

Through ceaseless testing for new and better materials and methods of manufacture, Leviton has developed electrical devices that meet unsurpassed standards of performance. From a simple tumbler switch to the most complicated wiring device, every piece represents the finest that skilled engineers and precision machines can produce. Whatever your installation requirements . . . look to Leviton.

Numbers 5001-5003 ere TYPE C T-RATED heavy duty switches. Number 5000 is a T-slotted heavy duty receptacle. Listed by Underwriters Laboratories. Meets R.E.A. and Federal specifications.

Your wholesale jobber has the Leviton device to meet your needs.



LEVITON MANUFACTURING COMPANY Main Office and Factory: Brooklyn 22, N. Y.





You'll save on tools and time with the new Weller Soldering Gun WD-250. Whether the job is rugged or delicate, your Weller Gun does it with the same ease and efficiency. Chisel-shaped RIGID-TIP provides more soldering area for faster heat transfer. New "over-and-under" terminal design gives bracing action to tip. Your Weller Gun is light-weight and compact, gets into the tightest spots.

Weller Guns actually pay for themselves in a few months. Fast 5-second heating saves time on every job. Trigger-switch control saves power—no need to unplug gun between jobs. Prefocused spotlight and longer length mean easy soldering, even when the job's buried deep. No other soldering tool gives you so many time-and-money-saving features. Order your new 250-watt Weller Gun from your distributor today, or write for bulletin direct.

SOLDERING GUIDE Get your copy of "SOLDERING TIPS"—new fully illust trated 20 page booklet of practical soldering suggestions, Price 10c at your distributor's or order direct.

MANUFACTURING COMPANY
815 Packer Street, Easton, Pa.



Transformer

(25)

A new low voltage heavy current transformer for heating applications complete with control panel has been developed. Available in a wide variety of kva capacities up to 500 and in any required combination of voltages and frequencies. Unit shown is of 40 kva capacity for 400 volt supply and has secondary voltages ranging from 25 to 100 volts with secondary current up to 1600 amperes. By suitable arrangement of tap changing switches any one of 16 voltages may be selected at will. All switches are interlocked to prevent operation with load on the transformer. Control equipment includes in addition to the tap switches a magnetic contactor and suitable indicating meters for voltage and current. Eisler Engineering Co., Inc., 750 So. 13th Street, Newark 3, N. J.



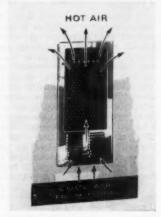
Air Conditioners

(26)

Six new models of industrial dry coil-vertical type air conditioners are available in sizes ranging up to 25,000 CFM per unit. They are ideally suited for refrigerated storages and in dairy, ice cream, meat packing, brewery and other processing plants in addition to cold storage warehouses. The coils are arranged for flooded operation with high or low pressure float control or liquid refrigerant pump recirculation. Low pressure receivers have external float control. Cooling coils are spiral fin pipe, continuous, hot dipped galvanized after fabrication. Fan section consists of multiple centrifugal fans mounted on a common shaft Vbelt driven by a single motor, Fan

motors, normally mounted on top of fan section can be mounted on front of conditioner for low head room installations. Variable pitch pulleys are furnished on all drives up to and including 3 hp. Dimensions of smallest unit are 81½ in. high, 50¾ in. wide and 31 in. deep while largest model is 101 in. high, 185½ in. wide and 39¾ in. deep.

York Corporation, York, Pa.



Heater

(27)

Two changes in the Quikheter, an electric, built-in type wall heater, have been announced. Previously operated by an independent wall switch, it is now made with a built-in switch to reduce time and cost of installation. This feature still permits use of thermostatic control where desired. Also, previously available only for 120 volt service, it is now made for 240 volt service as well as 120 volt.

Frank Adam Electric Company, 3650 Windsor Place, St. Louis 13, Mo.

Gas Torch (28)

Announcement has been made of a new LP portable gas torch with cartridge refill, that burns in both cold or warm temperatures. It is equipped with interchangeable burners. Torch lights instantly without pre-heating. Fully loaded, it weighs less than 2½ lbs. Torch will burn in any position. Some of its uses are for thawing frozen water pipes, industrial work, electrical soldering, brazing, tinning, melting lead or habbitt, cable splicing, silver soldering, etc.

Otto Bernz Company, Inc., 280 Lyell Avenue, Rochester 6, N. Y.

HIP-POCKET TROUBLE-SHOOTER!

SNAP-ON VOLT-AMMETER

estant current





LOOK WHAT YOU CAN DO WITH AN AMPROBE



- Spot motor and transformer overloads and underloads.
- Diagnose trouble-calls in a fraction of the usual time—by being able to check under actual load conditions.
- · Determine load conditions for contracting estimates.



- Check compressor back-pressure by reading motor starting current.
 - Load balancing.
- Trouble-shooting in the field (Manufacturers' field engineers).

and hundreds of other time-saving, troublesaving uses.



AMPROBE SPECIFICATIONS:

MODEL A-5

MDDEL A 5-1 AMPERES: 0/6.5/13/ MODEL A-A 26/65/130 amps 26/65/130 amps 50/100/250 amps VOLTS: 0/130/260 VAC VOLTS: 0/150/600 VAC VOLTS: 0/150/600 VAC

PREQUENCY: 50-70 cycles VOLTAGE BREAKDOWN TEST: 3,000 Volts A.C. Proven large D'Arsonval jeweled movement ACCURACY: ±3%

(of full scale deflection) SCALE LENGTH: 2.47 inches

PYRAMID INSTRUMENT

see it, try it today at all better electrical distributors

ONLY THE AMPROBE GIVES YOU ALL THESE FEATURES!

So compact, you can actually slip it into your hip pocket!

- 1/2 the usual size—anly 7"1
- 1/3 the usual weight-only 14 ez.1
- 1/2 the usual price-only \$42.751
- Can be roughly handled on the job without fear of
- Completely insulated—safe to use.
- Beautifully shaped and balanced for one-handed operation.
- Pointed probe jaws for working in tight spots lonly %" clearance needed.
- Measures 5 current ranges and 2 A.C. voltage ranges.
- * Field-proved and accepted—thousands in daily use.

An Amprobe in your hip pocket will save you enough time and trouble to pay for itself over and over again. Write today for Technical Bulletin 109D. Pyramid Instrument Corp., 49 Howard Street, New York 13, N. Y.

Morhan Exporting Corp. 458 Broadway, N. Y. 13, N. Y. Cable: Morhanex

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PYRAMID INSTRUMENT COMPANY 49 Howard Street, New York 13, N. Y.

Please send me Bulletin 109D describing the Amprobe[®] split-core volt-ammeter.

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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1950

It's the RIGHT ANGLE for Tough Spots...Faster Jobs

BIGGER **PROFITS**



NMATCHED for accuracy, time-saving, and speedy performance in close quarters, this remarkable new tri-speed HOLE-SHOOTER is the choice of electricians everywhere and a sure profit-builder for electrical contractors. It has no equal for speeding-up construction work and maintenance in industrial plants,

Adaptable to easy, usable positions, even in the tightest corners, this tool provides the most suitable speeds for boring with bits of every size, including expansive bits and hole-saws. Also suitable for drilling in steel and concrete.

See Your Wholesaler

If he cannot supply you, write us direct and mention his name. "You'll buy if you'll try".

MILWAUKEE ELECTRIC TOOL CORP. 5352 W. State Street, Milwaukee 8, Wisconsin

Milwaukee TRI-SPEED Kit for Electricians . . .

S-412 ½" HOLE-SHOOTER, ball and raller-bearing equipped...
Jacob's geared Chuck.. 450 R.P.M.

- *Two-Speed "Right-Angle-Drive" attachment . . . low side, 300 R.P.M. . . . high side.. 675 R.P.M.
- 3 special bits for boring in wood- $\frac{3}{4}$ ", $1\frac{1}{8}$ " and $2\frac{5}{14}$ ".
- A Special wrench for attach ing and adjusting "Righ Angle-Drive" and Chuck.

Adjustable "Long Arm" Accessory

Milwaukee



Receptacles

(29)

Two new dual purpose porcelain receptacles, for installation on either 31 inch or 4 inch outlet boxes have been announced. This flexibility is accomplished by providing a 4th inch diameter base, with open holes for 4 inch mounting, and knockouts for 31 inch mounting. The keyless, one-piece type features staked screws and handy angle contacts. Made with chain and threefoot cord, 7 inch chain, or chain and insulator. Removable porcelain rings release the Bakelite pull interior for

Arrow-Hart & Hegeman Electric Company, Hartford 6, Conn.



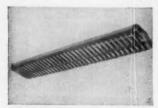
Hydraulic Jack

The GO-JAK pump unit is a footoperated precision made tool developing up to 20 tons pressure. Ideally suited for the assembly or disassembly of large parts, force fitted parts, and other machine shop and repair shop applications, it can also be adapted to, or built into, existing machinery. It has two speeds. A selector valve allows the operator to choose the right speed and capacity to suit the occasion. With the selector valve in the "out" position, the foot pedal will force the ram out quickly until the work is contacted. Unit then changes automatically

from high to low speed to take advantage of the full capacity of the ram. For light work the selector valve can be set to the "in" position and the jack will operate at high speed constantly. Unit is made for \$\frac{1}{2}\$ inch male pipe threaded fitting. An auxiliary \$\frac{1}{2}\$ inch pipe threaded hole is available for such application where a large reservoir of oil is required.

Wihtel Industries, Lewis Street, Eatontown, N. J.

(31)



FLUORESCENT lighting fixture for commercial installations has been announced. It uses four 96 inch T12 instant start single pin 75 watt slimline lamps. Unit has a one-piece lauver shielding assembly which is held in position by latches. Designed for surface or pendant mounting as an individual fixture or in units to form continuous rows. Manufactured by Sylvania Electric Products Inc., 500 Fifth Avenue, New York, N. Y.



Truck Body

(32

Announcement has been made of two new models, B-750 and B-910, of the "Carry-All", all-steel, all-purpose service and utility truck body. They fit all standard 1, 3 and 1-ton new and used truck chassis. The 48-inch width of the heavy-duty offset-reinforced nonskid 16-gauge floor and extra wide compartments (set out over the wheels) provide extra space for bulkier loads. They employ a center control dual latch locking arm which seals the door panels against a specially molded rubber gasket, giving a weatherproof and weathertight closure. Protection against theft is provided by individual cylinder positive action locks on each door.

Morrison Steel Products, Inc., Buffalo, N. Y.



Easy To Install

The simple, compact make-up of Latrobe Floor Boxes and Wiring Specialties permit them to be installed in record time.

The savings in time, labor and actual dollars thus gained is further improved by their smooth, dependable service after installation.



No. 110 "Latrobe" Watertight Floor Box

The neat compact design of the No. 116 Box quickens installation time and makes for smooth, trouble-free service. 208 Receptacle. Cover Plate is 3½° diam.



"Bull Dog" BX Cable Staples

Millions of these high quality staples are giving dependable service in all parts of the U.S. Packed in cartons, kees, or bar-



No. 470 "Bull Dog" Pipe or Conduit Hanger

Sturdy and dependable for hanging pipe or conduit $\frac{1}{2}$ ", $\frac{3}{6}$ " and i" to steel beams up to $\frac{3}{6}$ " thick. Larger sizes for larger pipe.



No. 252-R Two Gang Adjustable Floor Box

This No. 252-R Two Gang Box is adjustable and has our No. 208 Receptable in one section. One Cover Plate has 1/2" Floor Research than 2" Floor Research than 2" Floor Research than 2" Floor Research than 2" Floor Research



Keystone Fish Wire

Finest grade, flat steel wire in ten sizes, ranging from lightest work up to heaviest

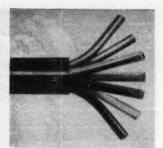


No. 284 Nozzle with No. 200 Cover Plate

Smart Duplex Receptacle Nozzie. Furnished with 1/2" or 54" Bruss pipe extension. Most and grantless.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA





Cable (33)

A PNR small diameter control cable for 600 volt operation, conductor operating temperature 168°F (75°) has been announced. Individual conductors are of stranded tinned copper No. 12 AWG 19/25 extruding with 16½ mils of polyethylene or No. 9 AWG 9/22 extruded with a 20 mil polyethylene wall. A 4 mil nylon jacket is extruded over polyethylene to add stability in increased ambient temperatures. Rockhide sheath is the overall sheath for the small diameter control cable. It is chemically inert and cable can be laid directly in acid or alkaline soils. Sheath protects cables from weather, sunlight and permits installations where chemical fumes are present. Permanent color coding on the polyethylene under the nylon is made in accordance with NEMA standards.

Rockbestos Products Corporation, New Haven 4, Conn.

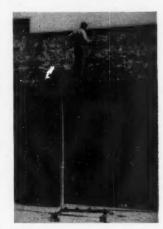


Instruments

A new line of portable instruments, designated type P-12, is available. Rated in the two-percent accuracy class, the line utilizes both movingiron and permanent-magnet moving-coil mechanisms. Line includes single and multiple range models. Ammeters are vailable in full-scale ranges from 20 microamperes to 50 amperes dc, and from 5 milliamperes to 50 amperes ac. For dc voltages, the full-scale ranges

run from 10 millivolts to 800 volts, with ac ranges from 1.5 volts to 300 volts. Rectifier milliammeters are available in full-scale ranges from 0.5 to 10 milliamperes, and rectifier voltmeters from two volts to 800 volts. Outline dimensions of meter are $3\frac{2}{16}$ in. wide, $4\frac{1}{4}$ in long, and 1.25/32 in. deep for dc type. The ac meter is the same size, except that depth is $2\frac{2}{16}$ in.

Westinghouse Electric Corp., Pittsburgh 30, Pa.



Ladder (35)

Announcement has been made of a new portable ladder, which is put up by one man in less than seven minutes. Ladder is of steel construction yet is lighter than aluminum. Can be carried in a passenger car. Ladder will extend from 4 feet to 24 feet. It comes equipped with a safe working platform, extra bearing plates and leveling screws for use in soft and uneven earth. It is easily knocked down for storing or carrying.

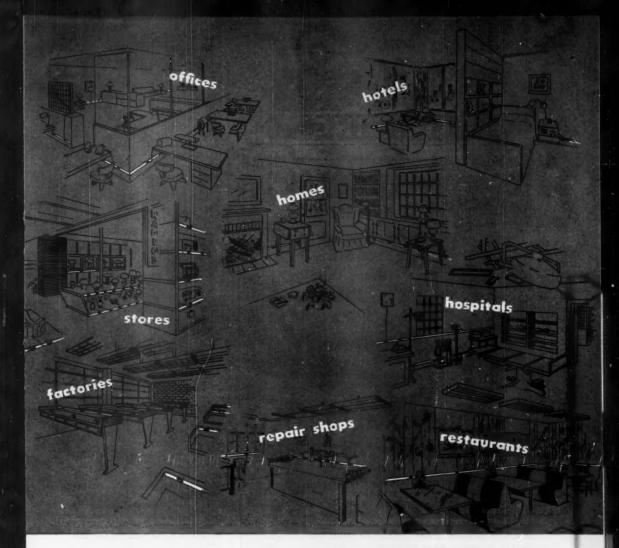
Atlas Industrial Corp., 849-29th Street, Brooklyn 32, N. Y.



Hydraulic Cutter

(36)

A new portable, hydraulic cutter for cutting insulated electric cable and armored cable up to 3½ inches O. D. has been developed. Called the "Guil-



Applications unlimited WITH PLUGMOLD

Wherever, whenever there is a demand for electrical plug-in-anywhere convenience, Plugmold is the easy way to provide closely-spaced, correctly-located outlets...enough outlets, in fact, to meet present as well as future needs of electrical service. In every case, added convenience is matched by added safety and appearance, by elimination of long, unsightly cords, clumsy multiple plugs, make-shift hook-ups.

No fuss to install... in new construction, entrance is from the back through wall or partition... in existing buildings, handy take-off fittings permit extension from present outlets in either baseboard or wall. And — with four Plugmold types — you have a choice to meet the specific requirements of every application...1900 Plugmold is available wired, unwired, or as Snapicoil (coils of prewired receptacles)...2100 Plugmold is available unwired, with a capacity larger than 1900.

When you plan outlet convenience . . . plan convenient Plugmold. Send today for complete information.







RLM Glossical Diffusors



INDOOR . . . OUTDOOR

Porcelain Enameled White Inside Green Outside



RIM Standard Dome



RLM Deep Bowl



RLM Angi

A Quality Standard that Promotes Better Business

Built up to definite standards for excellence of service, QUAD Reflectors fully meet user approval.

QUAD GLASSTEEL DIFFUSERS: Reflector and globe together may be taken down for cleaning without extinguishing the light or removing the hot lamp. Available with pendant, outlet box, or horizontal hood.

QUAD SOCKET REFLECTORS: 5 styles made in various sizes for general industrial illumination. Solid neck construction eliminates all exposed joints and seams. Each has a weatherproof top fitting and is available with shock absorbing sockets as well as the standard rigid socket.

QUAD SHADE HOLDER REFLECTORS: 5 styles made in various sizes. The Standard $2\frac{1}{4}$ " fitter adapts them for use with any screw or other type shade holder.

HEAVY THREADED REFLECTORS AND SOCKET HOODS: Especially serviceable for railroad yards and industrial locations where atmospheric conditions require sturdy lighting equipment that can be easily removed for cleaning. Made in 4 reflector styles.

• See the complete line in our Condensed Catalog No. 7

QUADRANGLE MFG. CO.

AST. CHICAGO 7, ILL

lotine", it is available with a choice of three portable pump units. Airhydraulic pump assembly operates off any source of compressed air supplying 100 lbs. pressure. It is also available with an electric hydraulic pump assembly for 110 volts or 220 volt operation. These two pump units are recommended for cable salvage work. In addition, the basic "Guillotine" cutting unit can be supplied with a separate hand pump assembly for work in the field.

Manco Mfg. Co., Bradley, Ill.



Instrument

(37)

A new Amprobe model, A-5-1, has been added to this series of small, pocket size volt-ammeters. It has seven ranges. 6.5/13/26/65/130 amperes and 150/160 volts. Instruments are designed specifically for maintenance men, engineers, electricians, and motor repair and service shops. Size is 71 in. long by 216 in. wide by 11 in. thick, and the split-core transformer will handle conductors up to 11 in. in diameter. Transformer core is permanently insulated with a molded plastic cover capable of withstanding 5,000 V. A. C. Case is insulated. Scale is visible from any angle, and range is clearly indicated. A plastic finger trigger opens the jaws, and the selector switch is operated with a flip of the finger. Meter has an accuracy plus or

minus 3% of full scale.

Pyramid Instrument Company, 49

Howard Street, New York 13, N. Y.

Motors

(38)

Announcement has been made of a new variable speed "Speed-Trol" motor, with provision for sealing speeds at a positive setting or within any predetermined range of speeds. In all

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . JUNE, 1950



plants where sanitary conditions are paramount a white finish can be supplied. Mounting dimensions are interchangeable with NEMA standard motors. It is available totally enclosed, splash-proof or dirt-proof. One application is for driving pumps for high temperature pasteurizing where pump speed may be sealed in accordance with sanitary regulations. Other applications include agitators, mixers, blenders, grinders, feeders, etc.

Sterling Electric Motors, Inc., Los Angeles, Calif.



Meter Socket Channel (39)

A new line of meter sockets and channels has been introduced. Conduit comes straight down into side of meter channel below terminals of meter. This connection keeps water out, as well as keeping the condensation which collects and runs down inside of conduit from getting back of jeweled instrument, the meter, and prevents dampness from deteriorating meter terminals, connectors and meter base. Sealing ring holds meter, terminal chamber and wiring compartment cover in place. Meter does not have to be moved for testing or inspection. One or more additional meter socket channels may be coupled without disturbing service.

Code Electric Products Corp., Fox Building, Philadelphia, Pa.

WAYS to slash costs on conduit installations





Now, THIN WALL Conduit can be bent profitably!
This new bender (No. 3-34) pays for itself on the
first good job. Handles 1½, 1½ and 2". Remotelycontrolled "Porto-Power" hydraulic unit creases exclusive advantages and also serves rigid-pip benders.

More speed on RIGID
Pipe, too! Bend sizes from
1" to 4". The hydraulic
ram works at any angle—
overhead, on the floor or bench.





Operate Knock-out Punches with HY-DRAULIC power! Save at least 60% of the job time. Punch holes up to 4½'' with surprising case. No wrench to swing!

Eliminate hand pumping! A motorized, portable pump (No. P-182) can triple the output of a pipe bender. It's spectacular on other hydraulic equipment, too!



Lift machinery, pull-pulleys. Dozens of allied jobs are licked by the "Porto-Power" hydraulic jacks which serve Black-hawk Electricians' equipment.

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HYDRAULIC "Porto-Power" EQUIPMENT

Savings in material costs and time are so large that it will pay you to get the full facts immediately on this low-cost equipment. Buy from leading supply houses.

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Rush free Catalog No. 50B on Black- hawk Electricians' Equipment.
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32-tooth ratchet action—paul all ways makes a double tooth contact for added strength. Snap-on Suprem 23-PC. MASTER SOCKET SET Many New

Features Combined to Give
Mechanics Most Value For Their
Tool Pollars!



Snap-on scores again with a new "Master Supreme" set of four handles, three extensions, a universal joint, and fifteen popular sized sockets. In this ½" sq. drive set you will find

highly engineered design, accurate balance, perfect fit, and a comfortable grip, that results in faster, safer, more satisfactory work. Every tool has a full chrome finish for long service life.

Check the features at the left, then ask the Snap-on man to show this set to you. Ask him to demonstrate — try the feel of the tools yourself. You'll agree that mechanics who use dependable tools like these will be a definite asset to your shop.

Over 4000 Snap-on tools are available through 41 direct factory branches located in key industrial areas.

*Snap-on is the trademark of Snap-on Tools Corporation



Easily removed Welch plugs permit cleaning and servicing of friction

Four-way sacket grip makes it easier and faster to interchange various units. Het broached chipcurled openings

ve you smooth ong socket walls.

ap-on metallurg-

Controlled heat treating combines surface hardness with skin-to-care toughness in every part of every tool.

select only grade alloy to produce on wrenches.

SNAP-ON TOOLS CORPORATION

8048-F-28TH AVENUE KENOSHA, WISCONSIN

Product Briefs

- (40) The Midwest Automatic Control Company, Des Moines, Iowa, has announced a new timer that controls the timing of operations of screens and pumps by means of an automatic rotor timer and an integrated system of wire terminals and controls enclosed in a single cabinet.
- (41) A new heat resistant wire marker that withstands temperature of 400° F and also resistant to solvents, has been introduced by the E-Z Code Division of Western Lithograph Company, Los Angeles, Calif. . . (42) Hermetically sealed enclosures for timers, suited to any application involving corrosive atmospheres or high humidity, has been announced by A. W. Haydon Company, Waterbury, Conn. (43) D. W. Onan & Sons, Inc., Minneapolis, Minn., has announced a new generator for tractor-drive.
- (44) Durakool, Inc., Elkhart, Ind., has announced three new technical advances in the manufacture of its metal-clad mercury switches and timer relays. . . . (45) A newly developed voltage tester is available from the Elwood Company, Buffalo, N. Y. Insulation will withstand 5000 volts. . . . (46) A new clear insulating varnish, known as No. 1100, has been developed by the Irvington Varnish & Insulator Company, Irvington, N. J.
- (47) A new 400-watt, 60-cycle, ac electric generating plant that will operate for five hours on a gallon of gasoline has been developed by D. W. Onan & Sons, Inc., Minneapolis, Minn. . . . (48) A new single or three phase homopolar inductor alternator with electronic exciter regulator, has been announced by American Electric Motors, Inc., Los Angeles, Calif. . . . (49) A new ac arc welder for "Heliarc" welding has been announced by the Millter Electric Manufacturing Company, Appleton, Wis.
- (50) H. D. Hunter & Co., Los Angeles, Calif. has developed a screw-holding screwdriver with rotating hardened steel pin in center of blade. . . . (51) A new indicating pyrometer, Model 192, for flush and surface mounting, has been announced by the Wheelco Instruments Company, Chicago, Ill. . . . (52) The Precision Engineering & Manufacturing Company, Saginaw, Mich. has announced a new butane-propane gas torch.
- (53) A copper clamp for splicing coaxial cable is being produced by Brach Manufacturing Corp., Newark, N. J. ... (54) Herman H Sticht Co., New York, N. Y. has developed a new hand tachometer of the single range type, Model "JP". . . (55) A new home and workshop kit, a three in one

tool used either for polishing, sanding or drilling, has been announced by Jones Motorola Corporation, Stamford, Conn.

(56) Custom Electric Controller Company, Harrison, N. J. has introduced the new Multi-Amp, a portable, high current test unit. . . . (57) John Hewson Company, New York, N. Y. has announced a new static control, known as Takk. It controls fire or explosion hazards in industry due to static electricity. . . (58) A new 300-watt narrow-beam spotlight lamp of the all-glass sealed beam type has been announced by General Electric's Lamp Department, Nela Park, Cleveland, Ohio.

(59) A new collector ring for slow speed operation to carry current up to 75 amperes at 200 volts has been developed by Industrial Electrical Works of Omaha, Neb. . . . (60) Atlas Industrial Corp., Brooklyn, N. Y. has announced a new marquee servicer for overhead maintenance, painting, lighting, cleaning, etc. . . (61) The Series CM cam recycling timer, manufactured by Industrial Timer Corporation of Newark, N. J., is designed to repeat a given electrical ON and OFF time cycle continuously.

(62) Model "BJ" Junior, announced by Electro Products Laboratories of Chicago, offers a new low cost dc source of filtered power, utilizing the same application of selenium rectifiers used in Model "B". . . . (63) A new radio interference locator for the 550 KC to 30 MC frequency range has been made available by Sprague Products Co., North Adams, Mass. . . . (64) Moen Ladder Co., Spokane, Wash., has developed for ladders, caster feet for mobility on the job, which are replaced for rigidity by aluminum feet flipped into position with a touch of the toe.

(65) The Pathfinder Company, Pasadena, Calif., has introduced a new light-weight high powered pipe locator. . . . (66) United States Gasket Co., Camden, N. J. has Teflon stock available in sheets, rods, tubes, bars and cylinders.

(67) Kato Egineering Company, Mankato, Minn., has developed a Katolight machine which can be arranged to provide six different frequencies. . . . (68) With the new 200 and 430 ma. slimline E.T.L. approved ballasts, each lamp operates independently of the other. Manufactured by Advance Transformer Co., Chicago, III. . . . (69) A new silicone-insulated, portable, ac welder, known as the 6WK20H series, has been announced by General Electric Co., Schenectady, N. Y. . . . (70) The Wheelco Instruments Company has announced a new control system to their Capacitrol line of indicating pyrometer controllers.



Again Irvington leads the way... with the most complete line of Class "H" insulations obtainable. Now, manufacturers faced with high temperature problems can successfully meet each specific requirement from this broad line. Designers, too, faced with the need to design more compactly, or reduce weights, can select insulations exactly suited to their needs. These Irvington Class "H" insulations are furnished in many thicknesses, and widths up to 36". Complete information, and generous samples, gladly furnished on request.

"Look to Irvington for Continued Leadership in Insulation"



*T. M. Reg. U. S. Pet. Off. by Owens Corning Fibergias Corp.

**T. M. Reg. U. S. Pel. Off.



"Oh, oh. My wife put my lunch in the wrong box. That was a ham sandwich we just wired!"

P.S. Let that be a lesson to you, Patso. Wiring a ham sandwich is almost as silly as installing inferior products instead of Pass & Seymour devices.





There's no corrosion, no short circuits due to moisture when you install P&S Weatherproof devices. Each device is sealed with cover and plate gaskets ... switches T-rated for Type C lamp loads . . outlets have constant-tension contacts, gripping both sides of the plug cap blades. The P&S Weatherproof device shown here combines an outlet and a single pole T-rated switch, 10 amps, 125 volts; 5 amps, 250 volts. This typical P&S Weatherproof device has Underwriters' approval, meets or exceeds all Federal and R.E.A. specifications. It is another example of P&S quality, dependability and easy installation — three reasons why P&S devices have been the choice of electricians and architects for sixty years!

PASS & SEYMOUR, Inc.

34 Boyd Ave. Syracuse 9, N. Y.

Maker of the famous P&S-Despard Line

Catalogs, Bulletins and Engineering Data

- (71) FIBERDUCT underfloor distribution systems, with typical layout plans, takeoff procedures and installation hints, are discussed in booklet 18-120 UF. General Electric Co.
- (72) Annunciators for use in control panels and desks, with wiring diagrams, specifications and text, are presented in 4-page file folder. The Autocall Co.
- (73) SIGN RECEPTACLE of the pin terminal type for use with 12 and 14 wire, medium base, 600 volts and 660 watts, is subject of catalog sheet. Union Insulating Co., Inc.
- (74) STARTERS of air-thermal design, for use with fluorescent installations, are discussed in 3-fold 2-color pamphlet. Industrial Starter Corp.
- (75) ELECTRICAL RESOLVERS, solving problems involving trigonometric functions, such as the rotation of coordinates, solution of triangles for angles and sides and the resolution of vectors, are subject of 12-page presentation. Arma Corp.
- (76) NELA PARK is subject of pocketsize booklet including the who, what, where and why of the Lamp Department's 20 plants. General Electric Co.
- (77) UNISTRUT concrete insert with continuous slot is discussed in Bulletin CI-2. Unistrut Products Co.
- (78) INDUSTRIAL CONTROL DEVICES for temperature, flow, pressure, humidity and liquid levels are described in catalog 8303. Minneapolis-Honeywell Regulator Co.
- (79) LIGHTING buyer's guide, outlining proper selection and purchase of equipment, is titled, "Your Lighting Simplified". Edwin F. Guth Co.
- (80) ELECTRICAL ENCLOSURES for industry, utilities and power plants, including control desks, cabinets, panels and cubicles, are presented in 16-page 2-color booket. The Kirk and Blum Mfg. Co.
- (81) VOLTAGE REGULATOR switch with mechanical interlocks to prevent open-

- ing line circuit is pictured and described in single-page file sheet D1-4. G & W Electric Specialty Co.
- (82) THE FACTS OF LIGHT, hints on buying planned lighting, is amusinglywritten pocket-sized folder written and sketched by Don Herold. The Frink Corp.
- (83) CARE OF AC ROTATING EQUIPMENT, 24-page presentation 05R7417, covers preventive maintenance, machine repair and operation. Allis-Chalmers Mfg. Co.
- (84) UTILITY PILOT LIGHTS for use in homes, institutional buildings and commercial plants, are presented in 4-page 3-color brochure. Cannon Electric.
- (85) Storage Battery technology handbook is 40-page discussion of charging and discharging, plate composition, operating principles and pertinent data. Gould Storage Battery Corp.
- (86) CONDUCTOR ENCLOSURES for figure-8 bars are specified and diagrammed in file folder. Calabar Corp.
- (87) ODD FREQUENCIES such as 15, 25, 180 cycles, available by machine designed for experimenting and testing purposes, are subject of Form 350 FCP. Kato Engineering Co.
- (88) Fractional Horsepower motors for business machines are described in 2-color 8-page bulletin GEA5420 with charts, construction data, performance characteristics and ratings. General Electric Co.
- (89) PORTABLE POWER from 250 to 36,000 watts, from 1 to 6 cylinders, 6 to 240 volts, air or water-cooled, gasoline or diesel-driven operation. is subject of 4-page file folder BE1. Universal Motor Co.
- (90) CIRCULAR SAW attachment for use with ½-inch hand drill is pictured, priced and described in single file sheet. Federal Engineering Co.
- (91) DC GENERATORS for lighting and power supplies is subject of 4-page

2-color publication B41-200. The Electric Products Co.

- (92) FILE SHEETS 48A and 49 describe basic switches combining high electrical rating with high inrush capacity and enclosured for type "A" switches. Micro-Switch.
- (93) CLEAN OILS, diesel, lube or turbine, through the use of cartridge purifiers, are discussed in 3 bulletins. Honan-Crane Corp.
- (94) Conduit elbows, couplings, nipples, goosenecks and running thread pipes are described and priced in catalog 201. Conduit Nipple Mfg. Co.
- (95) Insulated Cables for 0-2000volt working range for underground use, aerial work, signal and controls are specified and discussed in 2-color 16-page booklet. Simplex Wire and Cable Co.
- (96) Air Conditioners from 2- to 10-hp capacities designed for offices, homes, stores and apartments are presented in catalog PM 79-0100. General Electric Co.
- (97) ARC WELDING on the job, illustrated by photographs and sketches, is subject of 24-page news bulletin, The Hobart Brothers Co.
- (98) IN-AND-OUT REGISTER bulletin is 8-page illustrated presentation with drawings, tables and dimensional sketches. Cannon Mfg. Corp.
- (99) SAVINGS in floorspace and manhours through the use of storage racks, bins, counters, work tables and tool cribs are explained in 2-color multifold presentation. The Frick-Gallagher Mfg. Co.
- (100) Welding Failures are studied, and recommendations for overcoming the contributary faults are discussed in bulletin EU-55. Eutectic Welding Alloys Corp.
- (101) STAGE LIGHTING equipment of all types, with data and photographs, is subject of catalog 54. Kliegl Brothers.
- (102) FLUORESCENT STARTERS and lamps, with fundamental sketches, are discussed in file folder containing comparison chart for air-thermal and glow switches. Industrial Starter Corp.
- (103) LIGHTING REFERENCE folder H5 briefly describes companion incandescent-fluorescent fixtures for combining accent and general commercial illumination. Curtis Lighting Inc.

these proven PAINE devices help you do your job right..

Paine hanging and fastening devices have been tested in millions of different jobs over a span of more than 40 years. It is your assurance that Paine devices will work for you—save you time and money, just as they have for millions of other craftsmen. Choose from Paine's complete line of every size and style, and do a better job.



PIPE STRAPS

Paine Pipe straps are designed to support thin and thick wall pipes, conduit and armored cobles. They are of rigid construction, beoded for safety and added strength. Hole sizes are correct for proper nail or screen. Pipe sizes procedure the proper nail or screen. Pipe sizes plainly marked on each strap for your convenience. Packed 5 and 25 libs. In the cortion or in 50 and 100 lib. bags.

OUTLET BOX AND FIXTURE HANGER

Poine Outlet Box and Fisture Hongers are time and labor savers. Easily adopted for use in tile and metal ceilings and lath and pleatered wells and ceilings. 11" overeil spread of wings when open astablishes solid support of all times. Key in center of nipple may be turned by a screw driver to lock the wings in position after they are open—raiss key with screw driver to remove Ronger.



PAINE COMBINATION PIPE OR CONDUIT HANGERS

Poins Combination Pips or Conduit Hangers are made with a six-inch length of Performed Manager Iren and a gimel pointed long screw at one end and a pipe ring at the other. Beth are fostened to the Hanger Iren with plated belts and nuts — making a derivac efficiently adopted for use in tecating where quick, easy adjustability is important. Sizes of integral parts are properly proportioned for best service.



PAINE FLATTENED END LAG SCREWS

Paine Flattened End Lag Screws are made from finest quality steel. They are precision rolled and accurately threaded for use with malleable lag screw shields. Gimlet painted for easy insertion in wood. Fitted with stove botts at flattened end.

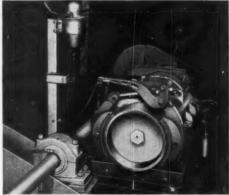
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Wagner Hydraulic Crane-Bridge Brakes have been service tested in industrial plants throughout the country. For safe, smooth stops—for controlled deceleration and close spotting—equip your cranes with Wagner "Full-Control" Hydraulic Brakes.

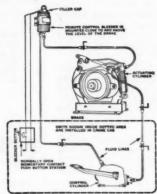
Only Wagner Hydraulic Crane-Bridge Brakes give you these features:

- . . . A Size and Type for Every Application . . .
 - Two types, with or without parking attachment, and four sizes are capable of handling any application.
- Remote Control Bleeder . . .
 - Keeps lines full of fluid, maintains peak braking efficiency, and makes bleeding the system an easy, "one man" job.
- e Self-Centering Device . . .
 - Prevents brake shoe drag by assuring equal clearance of both brake shoes.
- o Other Advantages Include . . .
 - Power failure braking . . . one-point shee adjustment . . . 200% emergency torque . . . grease fittings for lubrication . . . non-scoring, easily replaceable molded lining blocks.

If your cranes are not equipped with Wagner brakes, one of our field engineers will gladly show you how simple it is to install a modern hydraulic system. If you now have Wagner brakes, your system can be quickly modernized with our complete conversion kits . . . Bulletin IU-40 gives full information—write for copy.

An overhead traveling crane and your own automobile have at least one point in common. They both need the best brakes available to keep their power and speed under safe control.

Hydraulic brakes have long since proved to be the answer in the automotive field. Hydraulic brakes have also proved superior to all other types for the bridge drives of overhead traveling cranes. Hydraulic brakes for bridge drives are included in the Specifications for Electric Overhead Traveling Cranes for Steel Mill Service, AISE Standard No. 6, Revised May 1, 1949.



Controlled from the crane cab, the bleeder enables the operator to remove air from the fluid lines whenever necessary, simply by pressing a pushbutton and pumping the control cylinder foot pedal.

WAGNER ELECTRIC CORPORATION 6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Magner
Electric Corporation

FLECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES AUTOMOTIVE BRAKE SYSTEMS - ALE AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

Reader's Quiz

Breakers on Battery Circuit

UESTION 348—We have a number of 2300 volt, 3 phase, 60 cycle oil circuit breakers tapped off a common main bus. These breakers are closed and tripped by a 125 volt dc circuit. fed by a nickle-iron battery. Since we have been adding breakers, the question arises as to the capacity of the battery, and means of protection. I would like to know how the size of the battery is determined. Since this dc is required to trip a breaker in clearing an ac fault, continuity of de service is mandatory. What is the accepted practice in protecting the battery against faults in the dc circuit?-W.E.T.

TO OUESTION 348 - The • number of circuit breakers on a battery circuit depends on the lowest voltage that all the breakers would need if they should be asked to operate at the same time, plus the highest voltage that the breaker coils can stand without burning out. Since the coils are used rarely and for a very short time when they are used, the tendency may be for some firms to treat the power supply the same as the power supply of a group of apartment bells. The only difference is that 50 bell buttons in a single vestibule of an apartment building can be on a 5 watt bell transformer and draw no complaints, while a short circuit on the battery circuit can remove the ac circuit breaker protection. Or if many breakers try to open at the same time, thereby reducing the voltage available, so that while the dc supply is ok most of the time yet it is useless possibly once in a few years. I therefore suggest that you should consider the possible voltage loss when figuring the cost of a bigger dc supply. -H.S.

TO QUESTION 348 — As your 125 volt control circuit is fed from a nickel-iron hattery, it should not give you as much concern as though it were fed from a lead plate battery. Although the cell voltage of the nickel-hydrate, iron-oxide, potash solution battery is considerably lower

than the lead plate, acid battery, its charge and discharge rate is about double that of the latter. If the battery is floating with sufficient charging-current for the future load, its plates will not buckle on overload like the lead plates. This is not to infer that the nickel-iron battery cannot be overloaded but, if the discharge rate is adhered to as would be with the lead battery (with sufficient charging current behind it), the overloading could go nearly 50 percent greater than with the lead battery. The amperehour capacity of the secondary battery is determined by its "plate square area", its voltage by the "plates spacing" and "density" (specific gravity) of the electrolyte. The battery is insulated from ground and its breakers give overload and short-circuit protection. Continuity of service is assured by its charging source (gen. or m-g) being large enough to furnish both line and charging current when needed and, with the proper panel offers a duplex service. The nickeliron battery does not require the customary exercise (charge and discharge periods) to prevent sulphation, as does the lead battery.-J.V.H.

TO QUESTION 348—Bathours, and the ampere hour test is the
only way of proving the capacity storage of a battery. This is a tedious
test but it is the most accurate one.
Acid test and voltage test (under load)
are next best and the quickest method.

Nickle-iron battery has less heavydischarge than lead battery, but they last longer and are more efficient.

Fuse your conductors to carry the load, and to protect the conductors, not the trip coils. This will also in turn protect the battery.

On dc you can take the ohm resistance of the coils, and find out if you need more than one circuit or not. Look at the size of conductor and do not in this case use a diversion-of-load factor of the fuses.—M.C.T.

Motor Winding

UESTION 349—Would it be practicable to put a squirrel-cage winding on a wound rotor,

4 hp., 110 volt ac single phase commutator type motor? The old rotor winding is burned out and I have stripped it. Would this motor run O.K. if I put a starting winding in the stator?

—W.A.B.

TO QUESTION 349-No. I · doubt if it would be practical to make the proposed changes for this 1 hp., 110 volt motor. From an economical standpoint, the cost of labor and materials as compared with the price of a new motor would hardly justify this major repair. From an electrical standpoint, the performance of the motor is largely determined by the resistance and reactance built into the motor. Consequently, it is doubtful that the motor would perform satisfactorily unless the motor windings and squirrel cage were designed by a skilled motor designer, who would have to make a personal study of the present motor before attempting any work. I would suggest that you sell it for junk and buy a new motor. -E.C.E.

A TO QUESTION 349—It will behave like a split phase with a low starting torque or as a capacitor high torque motor. Most motors have enough place for a squirrel cage winding.—H.S.

Fuse Ratings

UESTION 350—For the past several years, high interrupting capacity fuses have been marked with two ratings, for example 100/65E. My question concerns which rating should be used. The recommended protection for a 100kva., 2300 volt, 1 phase transformer is 100 amps. Should we use 100/65E amp fuses, or 150/100E amp fuses?—W.E.T.

A TO QUESTION 350—Fuse rating standards have undergone several changes during the past decade which accounts for the double markings. The problem of substitution is simplified if the basis of these standards is known.



Complete Line EXPLOSION-PROOF

Class 1, Groups C & D





Meet ALL Standards PLUS

HEAVY DUTY and standard duty types. RUGGED INTERIORS with up to 5 point silver to silver contacts.

ROCKER ARM ACTUATING MECHANISM with silicone coated stainless steel shaft for permanent free operation.

EXTENDED MUSHROOM HEAD for quick selection and operation.

CORROSION RESISTANT baked enamel finish.

SMALL . . . suitable as components for machine applications.

GROUP ASSEMBLIES in compact. panel form for economical field in-

TYPE FS waterproof units.

TROUBLE-FREE, safe performance in hazardous locations insured by 48 years of design and manufacturing experience.

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RUSSELL & STOLL COMPANY, INC.

Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y

FLUORESCENT STA

-completely eliminate annoying blinking and flickering of dead fluorescent lamps!

GUARANTEED - FOR ONE YEAR!

PROTECTS - Automatic thermal relay cuts out defective lamps, eliminates annoying blinking and protects all auxiliary equipment.

SIMPLIFIES - Replacement of defective lamp automatically recycles starter circuit. No buttons to push - no replacement of starter.

REDUCES COST - Magno-Tronic starters provide exact timing of electrode heating, preventing ex-cessive loss of emission material, thus assuring maximum possible lamp life.

VERSATILE - Built to operate efficiently over an extended voltage and temperature range.

Demonstration and Literature on Request.



\$P-15-20 for use with 15 or 20 SP-30-40 For use with 30 or 40

SP-85-100 For use with 100 wett

U. S. PATENTS

2159837 2239244

Other Patents Pending

INDUSTRIAL ELECTRONICS CORP.

General Offices & Main Plant, 80 BANK STREET, NEWARK 2, N. J

The old 65% rating under NEMA Rule SG8-71 required continuous current carrying capacity at 65% of rating or, rated current for one hour from a cold start. Melting time, at 20 deg. C to 30 deg. C ambient was less than ten minutes at 150% rating in all but the very small sizes.

The succeeding 100% N rating required continuous rated current capacity at 40 deg. C ambient with a rise of 30 deg. or 150% rated current, starting cold, for one hour without visible deterioration. Melting was 230% rating in less than ten minutes at 20 deg. C to 30 deg. C ambient.

The present 100% E rating is the same as the N except that units rated 100 amp. or less shall melt in 300 seconds at RMS current within the range of 200% to 240% of continuous rating. Units over 100 amp. shall melt in 600 seconds within a range of 220% to 264%.

The inquirer does not state the conditions of service under which this transformer operates. The one amp. per kva, rule which he has applied has been used by utilities for distribution transformers and is not often applicable to industrial service. In most cases a much closer size can be used with better overload protection for the transformer.

In this instance, a 50 amp. fuse will permit continuous operation at 115% of the transformer rating and peaks of 230% to 275% for five minutes.

The writer would suggest that the owner secure copies of the fuse performance curves from the manufacturer to guide his selection in accordance with the duty required .-J.R.H.

TO QUESTION 350-Use • 100/65E amp. fuses.

The recommended minimum fuse rating for a 100 kva., 2300 volt, 1 phase transformer is 100 amp. Since March 2, 1942, the label for the required fuses carries a double current rating, as "100/65E amp.". The first figure, "100", is the 65% rating which has been used for many years and which appears on all fuses prior to the 1942 date. It represents the safe one-hour overload capacity of the fuse. The second figure, "65", followed by the letter "E", shows the new 100% rating now adopted by all high voltage fuse manufacturers. It represents the continuous current carrying capacity as defined by N.E.M.A. Power Fuse Standards Publication No. 44.93 .-

TO QUESTION 350-Fuse • ratings such as 100/65E and 150/100E refer to two systems of ratings. In the older days, fuses could not usually be operated continuously at the maximum rating. Thus a 100 ampere fuse was rated at 65% for continuous operation, or 65 amperes. Thus the 100/65E rating. The first is the 100 percent rating and the second number is the 65 percent rating. Present high interrupting capacity fuses are usually designed to carry their 100% ratings continuously. But to coordinate with older fusing practices, both the 100% and the 65% ratings are used. You note that recommendation for fusing a 100 kva. 2300 volt, 1 phase transformer is 100 amperes. Now the actual current of the transformer is approximately 43.5 amperes. Thus 100 ampere fuse is 230% of the transformer capacity. This is the practice of 1 amp. per kva. at 2400 volts. This would be based on using the 65% ratings (according to common older practice). Thus, the fuse to be used would be the 150/100E. If you use fuses based on the 100% basis, then you would use a 100 ampere fuse.-C.B.T.

Bank of Transformers

UESTION 351-We are planning to install a 2200 volt distribution system in an underground tunnel feeding several buildings. At the present, there is a 3-conductor 2/0 lead covered armored cable installed in the tunnel. It is proposed to tap this cable, and install a branch feeder of a 3 conductor, No. 8 or No. 6 cable to the different buildings, to a bank of transformers. These transformers will not be large, only from 50 to 100 kva. The distance from the junction to the transformers is from 30 to 50 feet.

Now the question arises, what type of junction boxes should be installed, fuse or not fused? One parly states that expulsion fuses would be a disadvantage, rather than an advantage, as the branch cables would be protected from overload by the proper fuses for the transformers, and it would be classed the same as an overhead distribution system. But in case of cable failure, it would be some advantage to have some disconnecting means.

If any readers have had experience with installations of this kind, will you please give us suggestions as to what equipment to install.—I.A.W.

A. TO QUESTION 351-The type of boxes to be used de-

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pends on the conditions existing in the tunnel. If underground or in a place where moisture or steam exists, water-proof type should be used. If the tunnel is above ground and dry and no moisture or steam exists, they may be standard pressed steel of size and thickness specified by the N. E. Code.

As your cable is armored, it is probably not in conduit, but iron boxes will be required for all taps and equipment in any case.

The protection of the taps is a matter of judgment taking into consideration the existing conditions, safety, continuity of service and ease of operation. On such short runs as you mention (30 to 50 ft.) and with adequate protection for short-circuit on the main 2/0 feeder, and at the transformer banks, I do not think any protection would be required at the taps.

However a tap feeder may fail. This would open the Main 2/0 feeder protection shutting down the entire system. If no disconnecting means is provided at the tap, a long and costly shutdown may occur. I would, therefore, suggest some disconnecting means at the tap that could be opened quickly to clear the system. This can be a simple disconnecting switch in suitable box. As this switch cannot be opened under load, two pilot lights should be installed at the switch. These are fed from the secondary side of the bank to indicate potential on the bus. The disconnecting switch box should never be opened when either of these lights are burning.

In a recent and similar installation with a rupturing capacity of 100,000 kva., we fed over sixty transformer banks, ranging from 15 to 300 kva... from a 4160 volt Y connected underground system with no protection at the taps, many of which were over 100 ft. in length. Each main feeder was fed from both ends and sectionalized by circuit breakers, in the manholes, at several points to limit the trouble to a short section of the feeder. Each bank could be fed from two separate feeders through interlocked oil circuit breakers at the bank. With this system, a short circuit would cut out that section of feeder and the banks affected would be thrown on the other feeder while repairs were being made. -A.E.T.

TO QUESTION 351—J. A. W. presents a problem which has often been met in actual practice. I have had both types of hookups. First, no fuses at all in the sub-mains leading to the transformer bank, using the transformer primary fuses for protection. (This is similar to outside line construction.) Second, using an oilswitch with overload trip at the submain takeoff point for disconnect

and line protection purposes, with standard transformer primary fuse protection. This is the best method. I do not favor using any type of single fusing in the individual submains. I have had some experience where such a practice was followed, i.e., single fusing in high tension submains and no individual primary transformer fuses. The result is sometimes very disconcerting when one fuse lets Transformers were delta connected and the loss of one submain left me with one transformer primary full voltage and the other two primaries in series across the remaining phase. In other words, even though one fuse had blown, I still had voltages from all three transformer secondaries. I favor greatly the oil switch or circuit breaker disconnect for the submains which will kill all three conductors at once. Keep clear of individual fusing in primary submains,-W.B.M.

TO QUESTION 351-Your A problem of tapping the 2200 volt cable is one in which the real answer should be based on practical application and use rather than on mere rules. True, it serves as a distribution system similar to an overhead line, but it is in a tunnel and probably there are other equipment in the tunnel, so that it would more properly be classed as being in a building. Thus, building rules, as developed by the National Electrical Code should be followed. It permits taps of not over 25 ft. and the tap must be at least one third of the cable size. (Sec. 243d of N.E.C.). As a separate consideration, it is good practice to provide overcurrent protection in order to localize faults. Thus, if a tap should fail, it would not put the entire system out.

Regular expulsion fuses should not be used. Rather, fuses designed for indoor application should be used. As your tunnel will probably be rather damp, I would suggest the oil immersed disconnecting fuses for this application. Several companies manufacture this type of equipment and I am sure they will be glad to work with you in selecting the exact devices for your particular set of conditions. We do not hesitate to call in some manufacturer's representative for working out details of such a project.—L.R.B.

Ship's Compass

QUESTION 352—We use electromagnets in the handling of both scrap and billets, both to and from barges on the river water-way. The tow-boat engi-

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NOCRETE

WITHOUT CONCRETE ENCASEMENT

RANGEB Fibre Conduit News

WITH CONCRETE ENCASEMENT

JUNE 1950

VOL. 1 NO. 4

CONTRACTORS AGREE – THIS CONDUIT LAYS FASTEST AND AT LOWEST COST!



cables. Its impermeable wall keeps out corrosive ground waters - resists acids, alkalis, salt, grease and oil. Orangeburg Conduit is tough, resilient—no cracking or breaking when properly handled.

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Just strip the wires, insert into connector, and twist. The spring expands and rolls a thread onto copper conductors. When you stop twisting, the spring tightens down and grips conductors firmly. Connector is skirted so insulated portion of wires is drawn up into connector for complete insulation.

Write for Information and Prices



IT ROLLS THE THREAD ON

THE M.B. AUSTIN COMPAN NORTHBROOK, ILLINOIS

neers have on occasion complained about the erratic functioning of their compasses when loaded with iron handled by the magnets. This condition is not alone common to them but also has further ramifications that reach out to the owners of ocean going ships, those that do not own a gyro-compass. Since such a compass costs in the neighborhood of \$15,000, it means that quite a larger number of tramp steamer navigators dislike paritally magnetized iron cargoes.

We are of the opinion that deviation tables can be satisfactorily worked out to compensate for any compass error occasioned by the magnets, depending, of course, on the type of metal in transit. It is also desirable to learn over what period of time the compass remains affected, once the offending cargo has been discharged. Any reader having hydrographic experience with the problem may be able to suggest answers .- P.C.Z.

TO QUESTION 352-Per-· haps you could employ some demagnetizing equipment on the cargo after it is loaded on the ship. Put an ac field around and through the cargo.

Also, the ship could be wired with a system called "degaussing" or similar method, to control the magnetism in all parts of the ship.

Compensating coils on the compass would not be too good, without the ship itself having been wired with the above system.

If you are using direct current on your lifting magnets, get rid of it, and use alternating current. Seems as though you must be using dc to have so much trouble as you mentioned.

Your magnetism will remain in the cargo a long time, once it is charged, especially if it is hard steel .- M.T.

TO OUESTION 352-The • factors affecting the accuracy ot a ship's compass are both the induced and permanent components of the earth's magnetic field. To elaborate—a piece of magnetic material placed in a magnetic field will concentrate the lines of force through this piece of material and intensify the strength of the magnetic field in that region. This is induced magnetism. When the magnetic field is removed, the induced magnetism disappears but a smaller amount of permanent magnetism remains.

A ship being of steel, is acted upon in the same manner and has both induced and permanent magnetic fields which effect the compass. A cargo of magnetic material will increase the induced field and may result in a change of the permanent magnetism of the ship's hull. This will make the existing compass deviation table inaccurate. It is recommended that the ship be swung and compasses adjusted after taking on a cargo of magnetic material and after discharge of such cargo. By doing this, the compasses will have accurate deviation tables for both conditions. But it must be remembered that the deviation table for one cargo will in all probability not hold for other such cargoes.

With regard to the effect of magnetized steel on a compass and the duration of the effect after removal, I believe that no accurate estimate can be made because of the several factors which must be considered. One such factor is the kind of weather during the trip. A ship going through a storm and heavy seas may have its permanent magnetism changed, and so throws the deviation table off.

P.C.Z.

Can you ANSWER these QUESTIONS

QUESTION U16—Some engineers maintain that immersion heating elements may extend ½ inch above the water surface. Are they correct?—H.S.

QUESTION V16—In the use of two wattmeters for the measuring of power in a three phase circuit, what causes the reading of one wattmeter to decrease as the power factor decreases? The power factor of the circuit which I was measuring was less than 50%. —E.J.K.

QUESTION W16—Please tell how to locate a ground on an insulated delta 220 volt system without shutting down the system.—R.L.

QUESTION X16—In the plants in which I work, they have emergency batteries consisting of 60 cells each. These batteries are usually floated on a bus at 129 volts. Each month the batteries are checked for the voltage of the individual cells. Before checking the cells, the charging voltage is raised to 140 volts and left at this pressure for one hour. The cell voltages are read and recorded then the voltage of the charger is reduced to 129 volts. Why is the voltage raised and left so for an hour before checking the cells?—H.G.R.

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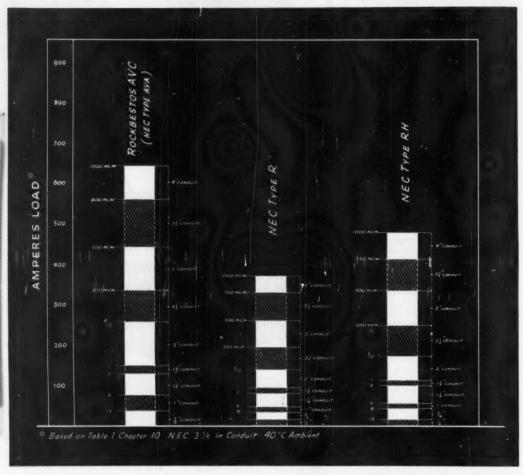
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Questions on the Code

Nonmetallic Wiring

On a recent rewiring job, I fished several pieces of Romex through a cold air duct to reach the second floor of a house. Now there is some question as to whether or not I have violated the local ordinance. Is this also a violation of the Code and if so, why?—L.M.

Yes, the N. E. Code does not A permit the use of any ventilating ducts as wireways for any nonmetallic type of wiring installation. Under Section 3020 you will note first the reason and second the type of wiring permitted. The section reads as follows: "Electrical installations shall be so made that the possible spread of fire through fire stopped partitions, vertical shafts, ventilating or air conditioning ducts is reduced to a minimum. No wiring system of any type shall be installed in ducts for dust, loose stock or vapor removal. Where it is necessary to run a wiring system through air conditioning ducts or plenum chambers, the wiring method shall be rigid conduit, flexible steel conduit with lead covered conductors or type ACL armored cable with fittings suitable for the location. The terminals of circuits of such wiring systems shall be so located that it will not be necessary to install motors or control equipment in the ducts, except for temperature and humidity control. Raceways shall not interfere with the operation of automatic fire dampers in ducts." The use of any nonmetallic wiring of any type within a duct is prohibited to prevent the rapid spread of fire which could occur in the event of an electrical fault -GR

Show Windows

Is it necessary to increase the assumed load of 200 watts per foot of show window by 25% as is required for other circuits within store buildings or is this already included?

—M.C.H.

A. Yes, it is necessary to increase this assumed loading by 25%-

as Section 2116 provides that minimum unit loads provided for under this section shall be increased by 25% in order that the wiring system may have sufficient capacity to insure safe operation. Then under subsection 2116-c-2 you will note permission is given to assume 200 watts for each linear foot of show window measured horizontally along its base. In other words, it is not necessary to use 200 watts per linear foot, you may instead use the specified load per outlet if you prefer. The 1940 edition of the Code required the use of 200 watts per foot regardless of the number of outlets, but the present edition dropped the mandatory feature.-G.R.

Fire Alarm Circuit Wiring

In installing fire alarms in apartment buildings, schools, or other buildings, can conduit or steel tube or armored cable wiring be used and can ordinary outlet boxes be employed, or must threaded hub boxes be used?—J.A.H.

A If the source of current used for the fire alarm system is from primary batteries or from transformers having current limiting characteristics (such as bell ringing transformers), the circuits may be installed in accordance Sec. 7292 of the N. E. Code. Conduit or armored cable or

tubing would not be required nor would the use of boxes be required.

If the current supply is not limited as indicated above, any type of wire recognized in Chapter 3 of the N. E. Code would be permitted, if installed in accordance with the rules of Chapter 3. Threaded hub boxes would not be required unless the system was installed in a hazardous location.

FNMS.

Grounding Outlet Boxes

Q. Is it necessary to ground outlet boxes in basements wired with romex?—R.I.

A if the boxes are conductive and are within reach of a person standing on the floor or within reach of grounded objects, the boxes must be found in Section 2542 of the N. E. Code and Section 2557 contains the rules for method of grounding the boxes.

If nonmetallic sheathed cable is used for the wiring material in a basement, this section provides that either a separate grounding conductor may be used or a three conductor cable may be used, the grounding conductor in either case may be bare or insulated. Outlet boxes beyond reach need not be so grounded unless they are in contact with metal lath.



ELECTRICAL INSPECTORS of the city of St. Paul, Minn., are: (L to R) H. P. Adams: senior inspector P. H. Shillock; J. A. Chambers; and Ted Warnlof.



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Underground Wires

Our inspector has requested that we tape the underground wires together every couple feet before we place them in a trench. Is this required by the Code?—C.A.S.

No, the Code does not require that the individual conductors be taped together, but the closer the conductors of a circuit are to each other the less the resistance of the circuit. Therefore the electrical inspector is suggesting that you provide the maximum circuit capacity for the copper used in the circuit.—G.R.

Conductors

At a Code meeting some time ago I was told that the carrying capacity of underground conductors approved for direct burial could be the same as for conductors in air as found in Table No. 2 of the Code. Now I have been told by an inspector that I must change the feeders between two buildings because they do not have sufficient capacity. It seems that the three wire cable that I used was wrong. The inspector also said that even if I had used single conductors and protected them with thinwall inside of both buildings Table No. 1 would apply and not Table No. 2. What is the Code ruling on this?-FAB.

A of the Code, you will note that it refers to individual conductors when within conduit or cable. Therefore the inspector was correct in rul-

ing that Table No. 2 does not apply to conductors within cables. It probably would be safe to use Table No. 2 for individual type USE conductors buried in the earth. However, even that may prove unwise as it is quite common practice to use conduit for protection whenever the conductors are brought above ground.—G.R.

Wiring For Gasoline Pumps

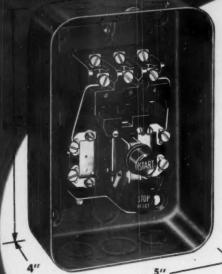
When wiring for gasoline pumps on an island in front of a service station, should the underground conduit be sealed off at the island or at the wall switch in the station?—A.M.G.

Sections 5142 and 5143 provide . that all wiring within 5 feet vertically or 20 feet horizontally of a gasoline dispensing pump must be the Class 1 type. Section 5142c also states that all conduits must be sealed as they enter dispensing pumps or other equipment on the island. Then under Section 5015b2 you will note that each conduit leaving a hazardous area cannot have any fittings between the seal and the point at which the conduit enters the hazardous area. Therefore it is necessary to place a sealing fitting at the pump island and also somewhere in the conduit between the switch cabinet in the station and a point outside the station 20 feet or more from the island. If the pump island is 30 feet or more from the building, the sealing fitting cannot technically be placed within the building without violating the provisions of Section 5015-b-2 .-G.R.



MORE ELECTRICAL INSPECTORS are needed in the North Dakota area believe (L to R) contractor R. J. Berger, Miller-Berger Electric Co., New England, N. D.; E. E. Dockter, chief electrical inspector, North Dakota State Electrical Board; and contractor F. J. Miller, Miller Miller Electrical Co., Dickinson, N. D.

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Yes — you'll stop and start, many thousands of times, with the Arrow-Hart Type "RT" Manual Starters designed for quick, easy installation and maintenance and for long, dependable service. All components of these sturdy, compact units are readily-accessible from the front. There's plenty of room in the box for wiring; contacts can be inspected, replaced, without removing the unit from the enclosure.

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No. 1395-W Dustproof Starter. 1-, 2- and 3-phase; 2-, 3- and 4-pole.

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The construction of contact holder makes servicing fast and easy. Plenty of room for wiring. Parts may be removed conveniently, quickly and easily; replacement is done on-the-spot.

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Reach right in, loosen two captive screws and the contact carrier comes out quickly, easily and without removing unit from the box.

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SIZE "0" - Cat. Nos. 1390, 1391, 1394 MAX. H.P. RATINGS, A.C.

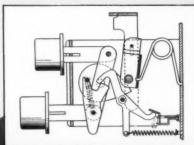
VOLTS	110	220	440-550
Single Phase	1	11/2	11/2
Polyphase	11/2	2	2

SIZE "1" — Cat. Nos. 1392, 1393, 1395

	220	440-550
11/2	3	5
3	5	7 1/2
	1½ 3	1½ 3 3 5

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The compact mechanism design and fine quality latching elements provide rugged and dependable central. Ample space within the box allows for easy installation and maintenance.



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SCHOOL LIGHTING **ECONOMICS**

[FROM PAGE 64]

System No. 3 will provide similar results but with slightly higher ceiling brightnesses. The brightness distribution shown in Fig. 7 is directly applicable to System No. 6, but may be considered typical for most of the directindirect luminaires shown. Louver and lamp brightness will actually be slightly lower than indicated for twolamp luminaires and will be somewhat higher for 96 W (600 ma) T-12 slimline units and 69 W (300 ma) T-8 slimline units.

The ultimate in seeing comfort will be provided by systems Nos. 9, 10, 11, 18, and 23, but it can be obtained only at considerable additional expense and is often not within the financial means of a school.

General Conclusions

The selection of the lighting system which best meets the requirements of a given school depends upon many factors, of which cost is only one. Initial investment is a poor and unreliable means of comparing costs, for it does not take into account extreme differences in operating costs. Low or moderate cost installations that do not provide adequate illumination, or that create uncomfortable seeing conditions are poor investments since only slightly more money (and sometimes less) is required for systems that satisfy the seeing requirements. Systems employing four-lamp luminaires are less expensive than comparable installations of two-lamp units. Two row installations are generally more economical than three row installations because of reduced installation cost. Similar savings may be noted when continuous row costs are compared with those of individually mounted luminaires. Except for initial investment, most fluorescent installations are less expensive than incandescent. There is but little difference between costs of comparable standard fluorescent and slimline installations, but systems utilizing low brightness lamps or semi-indirect luminaires may be quite expensive.

Lighting layouts other than the 23 popular-use layouts shown in Table I can be easily analyzed and compared by making the computations indicated in the Table. Such analysis and comparison should be made on any new type lighting layouts before they are recommended, especially where economy is a factor in the school lighting

program.



What are the first two questions an electrical contractor asks about a service body?

The first is . . . HOW'S IT MADE?

2 And the second . . . WHAT'LL IT DO FOR ME?

And here are the answers . . .

How's it Made?

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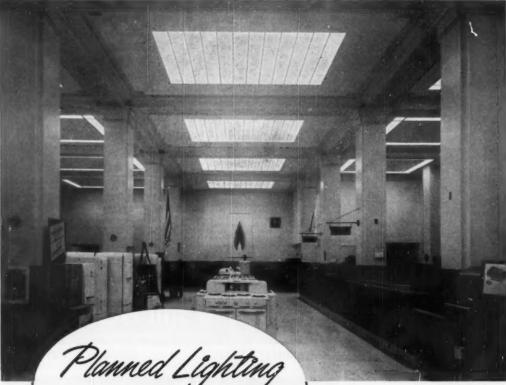
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Appliances stand out clear and sharp . . . with every feature distinct . . . in this newly relighted showroom of the Providence Gas Company. It's the first step in a new modernization program. And evidence of the unusual lighting results obtainable with Litecontrol's new, luminous ceiling.

Optically engineered, this new ceiling features Holophane

No. 9015 CONTROLENS* to give high intensity ... practically shadowless ... illumination. It's a flexible light source that easily fits any structure. Easy to control, too ... use one-half the slimline lamps or turn them all on for extra lighting punch. Why not write today for more information on this new ... and better ... light source by Litecontrol.



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Fixtures

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EITECONTROL CORPORATION, 36 Pleasant St., Watertown 72, Mass.
BESIGNERS. ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING
EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

PROVIDENCE GAS COMPANY Providence, R. I.

Engineered by the WALKER ELECTRIC CO., together with HOWE, PROUT & EKMAN, Architects Area: Approximately 414 square feet per bay Waltage: 1100 per bay

Ceiling Height: Approximately 16 feet Average Intensity:

All lamps on, 76 Footcandles Initially
Alternate lamps on, 44 Footcandles Initially
Brightness Readings:

Walls, 0.12 Candle per square inch Floor, 0.12 Candle per square inch

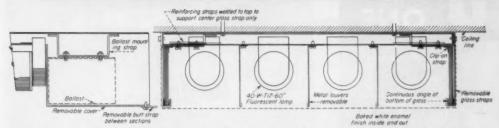
Fixture — Along lamp axis: 45° - 1.46 Candlepower per square inch 30° - 0.76 Candlepower per square inch



LITECONTROL Luminous Lens Ceiling ...

is the logical answer whenever a practically shadowless, low brightness, flexible, light source is desired. Just hang the angle frames with Holophane No. 9015 lenses from the old ceiling. Use slimline strip fixtures in varying lengths, spacing and wiring arrangements to get intensities desired.

Modern Lighting



SECTION THROUGH FIXTURE indicates position of metal removable louvers between lamps, side glass panels and end housing for mounting ballasts.



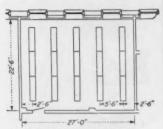
AVERAGE OF 80 FOOTCANDLES is maintained in Consumer Record section of Central Hudson Gas & Electric Corporation's new addition to their main office in Poughkeepsie, N. Y., with installation of low-brightness lamps mounted in specially designed Litecontrol fixtures.

Utility Lighting Stresses Quality and Quantity

Lighting quality and quantity are highly rated in the new addition of the Central Hudson Gas & Electric Corporation's main office located in Poughkeepsie, New York. For these factors were considered in conjunction with preliminary architectural plans and the lighting system was designed so that furniture could be shifted and departments relocated without disturbing the high, even illumination level maintained on all working areas. Maintenance also was considered, with the result that the specially designed fixtures are easy to relamp and equally easy to clean.

Typical of the lighting installed throughout the office building is that existing in the Consumer Record section; a 27- by 22.5-foot area with a 10.5 foot ceiling height, having three windows along one side. In this area, on 5.5-foot centers, five three-unit rows of fixtures are surface mounted on the acoustical ceiling; units being Litecontrol Specials, with four 40-watt 60-inch 4500-degree white T-17 lowbrightness lamps in each fixture. Removable metal louvers mounted between and parallel to the lamps obtain a 40-degree cutoff, while diffusing glass side panels permit soft illumination of ceiling panels between fixture runs. With a room area of 610 square feet, the installation requires 4.9 w/sf to maintain an average of 80 footcandles with the range extending between 75 and 90.

Excellent light quality is indicated by footlambert readings, for levels on



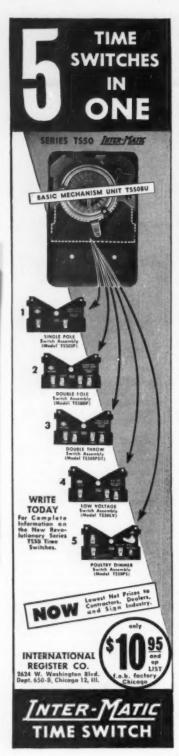
LIGHTING PLAN calls for five threeunit rows surface-mounted on 10.5foot ceiling at 5.5-foot intervals. Installation requires 4.9 watts per square foot.

side glass panels at a 45-degree angle are 510, on ceiling areas 2 feet away from luminaires they are 350, and on horizontal baked white enamel louvers at a 45-degree angle they are 615. White paper on desk tops produces 90 footlamberts, while front wall readings are 70 (1 foot down from the ceiling) and 45 (at eye level).

The color scheme includes a cream grey ceiling, light grey to the chair rail, and French or medium grey to the floor. The floor proper is mottled tile.

Employees working under this lighting express their approval for both the quality and quantity of illumination, and the Central Hudson management stresses their satisfaction with this lighting uniformity for areas where maximum flexibility of furniture arrangement is desired.

The lighting units, manufactured by the Litecontrol Corporation and specified by Illuminating Engineer Taylor M. Barr of the Central Hudson G. & E. Corporation, were installed by Electrical Contractor F. H. McEnaney of Poughkeepsie. Francis Keally of New York City was the architect for the new extension.





PLANNED LIGHTING was a major feature of a remodelling program at Esserman's store, Rome, Ga. Wakefield "Grenadiers" provide 50 f.c. general illumination, and incandescent spots light feature displays.

Store Modernization Features Lighting

Esserman's, a large specialty shop in Rome, Georgia, recently completed a remodelling program carefully planned for the pleasure and convenience of its customers. A modern planned lighting system was a major feature of the remodelling program. Other features included air conditioning, a public address system, and smart and eyepleasing color combinations of harmony and contrast in the repainting of the store interior.

Shielded and louvered Wakefield "Grenadier" fluorescent units, ceiling installed in geometric patterns, furnish a general illumination level of about 50 footcandles throughout. Incandescent R-40 spotlights, in metal housings which are designed for in-

stallation as a part of the "Grenadier" units, are located at all 90-degree junctions of the fluorescent units and at 4-, 8- and 12-foot intervals in all straight runs. These spots enable feature displays throughout the store to be highlighted and featured as desired, with intensities up to 150 ft.

Located "in the heart of Rome since 1896", Esserman's can now stake a claim as one of Georgia's most beautiful and best lighted stores. Combining utility with splendor, the lighting system is serving as a model for other stores throughout the States. The lighting was planned by lighting engineers of the Georgia Power Company in cooperation with the architects, Poundstone, Godwin and Ayers.

Scoreboard Combines 3 Types of Lighting

An effective electrical scoreboard, combining both pushbutton and manual control and utilizing both neon and incandescent lights with and without diffusing mediums, keeps fans informed of the status of all games played in Florida's Miami Stadium. The board, erected by the Claude Southern Corporation, has several advantages over conventional installations and resulted in reduced installation costs, greater legibility and rapid changes of important information.

Data which are constantly changing, such as the time, the number of a latter or the number of strikes, balls and outs, are flashed upon standard multiple-lamp panels by means of automatic pushbuttons, permitting one

operator to activate several panels from a single location.

Information which does not change (such as the names of the teams on the field) or which changes only intermittently (such as the score by innings) is placed on the board manually, applying the principle of theatre marquee displays. This information appears as black on white, with the opaque letters and numbers supported by horizontal bars positioned in front of back-lighted opal glass sheets. The team names are placed in position from the front of the scoreboard before the game begins, while the inning scores are inserted from the rear of the board while the game is in progress. To do this, special display



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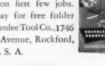
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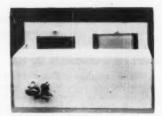




ELECTRICAL SCOREBOARD installed in the Miami Stadium can be read plainly during games played either at night or in the daytime. Two light sources (incandescent and neon), two color combinations (black on white and vice versa) and two methods of changing scoreboard data (pushbutton and manual) are combined.







SPECIAL DISPLAY BOXES, a product of Wagner Sign Service installed by the Claude Southern Corporation, provide facilities for back-lighting, ready change of information, opal glass diffusion and either permanent or plug-in wiring. Cost of this installation was far below that of conventional all-automatic scoreboard; visibility was greater.

boxes were obtained from the Wagner Sign Service, consisting of small panels that tilt to the rear. Numerals are readily slipped into position, pushed forward into the vertical plane, and held in position by means of a small turn-buckle at the top of each frame. Since changes in score are recorded only when the teams are changing position between each inning, the same operator who is responsible for the pushbutton operation of the multiplelamp panels can change the backlighted score frames.

To give variety to the board, secondary lettering and numbering, such as the words "time, balls, errors" and the inning designations above the various panels, is executed by neon tubing.

By using the combination of light sources and treatments in this manner, the cost of the board was found to be far below the estimate for a completely automatic board and, at the same time, the score could be more easily read by fans sitting at the rear of the stands.



OFFICIAL FAMILY of Electric Motor Service Association (Central District Chapter, NISA), Chicago includes: (L to R) President-Paul Sievert, Sievert Electric Co.; vice-president-Baird Rogers, Rockford Power Machinery Co., Rockford, III.; secretary-H. W. Reeve, Inland Industrial Electric Service Co.; treasurer-E. K. Nettgan, Arthur Wagner Company.

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These 4 MODULES are the "BUILDING BLOCKS" of LIGHT



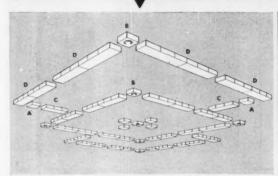






4 14-Watt T-12 15" Type F Lamps 32-Watt 12" Circline Lamp, and 1 PAR Spot or Flood Lamp 4 40-Watt T-12 48" Type F Lamp

They fit together like THIS—for lighting magic like THIS





50,000 different patterns possible-20% more light

It's amazing! With just 4 simple, low cost "building blocks of light", MITCHELL MODULE offers unlimited custom-fitting lighting patterns to fit any commercial interior. MODULE's exclusive plastic louver passes 20% MORE LIGHT. Simple fitting together of units (mechanically and electrically) permits low cost rearrangement of patterns at any time to suit changing needs. MODULE mixes all light sources smoothly in one harmonious, handsome system—puts the light exactly where it's needed. No ordinary fixtures can match MODULE—the only lighting that custom-fits with standard low-cost units.

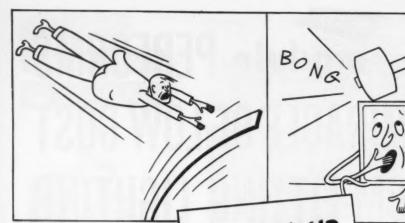
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New 2-7½ HP Manual Starters save "crossing your fingers"

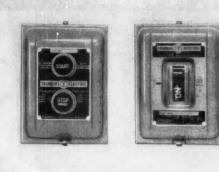
But It Won't Act When It Shouldn't

Unique latch mechanism minimizes false trip-out. A trigger mechanism gives positive, quick-acting tripping on overload—reacts only to bending of heater strip, not to vibration or knocks. And metal guard protects toggle or push-button from accidental operation.



It's Even Hard for the Operator to Do Wrong

No parts to replace after overload. Contacts cannot be held closed against overload. ON, OFF, RESET positions clearly indicated on toggle type; START and STOP on push-button types. Resetting directions clearly visible on both types. Line and load circuit numbers on barriers between contacts. Covers and toggle can be locked.



PT Means "Push-button or Toggle" ...in All Sizes

All sizes of Trumbull's PT Starter available with pushbutton or toggle operation in general purpose enclosures. Water-tight or explosion-proof enclosures are also available. Fine silver, butt-type contacts are easily inspected. Write for Bulletin PT. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn.

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TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

In the News

G.E. Train Touring Country

The More Power to America Special has been launched on a nationwide tour by the General Electric Company's Apparatus Department, oldest and largest of the company's nine operating departments.

The purpose of the train is to enlarge the market for electric equipment, and at the same time to disseminate engineering "know-how" of help to American industry. The train consists of ten cars, eight of which are filled with exhibits of the most modern electrical products, systems, and techniques for profitably producing and utilizing electric power.

During its tour, the train will be inspected by invited representatives of electric utilities, the manufacturing and transportation industries, the armed services, the federal government, and municipalities.

IES East-Central Regional Conference

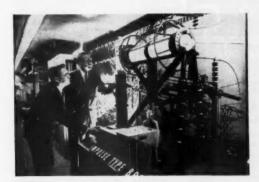
The five sections and chapters comprising the East-Central Region of the Illuminating Engineering Society held their annual Regional Conference in Philadelphia, Pa., on May 18 and 19, at the Hotel Warwick. With a membership of over 800 in the Region, nearly 200 members and guests from the Philadelphia, Pittsburgh and Capitol (Washington, D. C.) Sections, and the Baltimore and Eastern Pennsylvania Chapters, registered for this two-day meeting.

The opening morning session of the conference was chairmanned by W. R. Robinson, chairman of the Eastern Pennsylvania Chapter. This session consisted of an address of welcome by Regional Vice-President J. S. Schuchert, Duquesne Light Co., Pittsburgh, keynote address by George E. Whitwell, Vice-President of the Philadelivell,

phia Electric Co., Philadelphia, Pa., and the presentation of a Planned Lighting Skit—"Light Up Tomorrow" —sponsored by the Better Light-Better Sight Bureau of the Edison Electric Institute.

In his keynote address, Mr. Whitwell stressed the economic and social dangers faced by all segments of the lighting industry inherent in current federal trends toward socialism and nationalization. He very capably and clearly pointed up these dangers by summarizing and illustrating with slides the nationalization of the electric power industry, much of which has already been accomplished and some of which is still under way.

The skit, "Light Up Tomorrow", was a pertinent and dramatic presentation of the whys and wherefores of Planned Lighting. Directed by Harold H. Green of the General Electric Company, Nela Park, Cleveland, it used a cast of fourteen players who repre-







- H. V. ERBEN (right), vice-president and general manager apparatus department, and J. S. Smith, manager of the department's advertising and sales promotion divisions, operate a model of a huge 230 kv impulse breaker in the Power Generation section of the train. (Upper left)
- K. R. VAN TASSEL, manager of the control divisions, tries his hand at operating one of the exhibits. (Upper right)
- C. H. LANG, (left), vice-president of charge of sales for the apparatus department, and C. P. Fisher, Jr., manager of the Apparatus Exhibit Train Division, "spot" a dummy load in the Materials Handling section of the train. (Lower left)
- **E. A. GREEN**, centrol divisions sales manager, operates one of the control exhibits. (Lower right)





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CONTRACTOR E. F. Johnson, Elton Electric Co., Sioux Falls, S. D., has corridor chat with T. Ralph Neilson (right), manager, Electrical Contractors Society of Washington, Seattle, at recent electrical industry convention in St. Paul. Minnesota.

sented practically all branches of the lighting industry, including the trade press, and covered, in addition, the fields of home, school, office and store lighting.

The first afternoon session was chairmanned by A. S. Raffel, chairman of the Baltimore Chapter. This session consisted of three technical papers. The first was on "Color and Its Measurements" by Dr. D. B. Judd, National Bureau of Standards, Washington, D. C. Dr. Judd used many slides and charts, and much demonstration equipment, including a self-illuminated chromaticity chart or diagram, all of which helped to clarify and simplify this otherwise difficult technical subject.

The second paper was on "Lighting from Louverall Ceilings and Other Large Area Luminous Surfaces", and was presented by Don P. Caverly and Robert R. Wylie, both of Sylvania Electric Products, Inc. Many of the problems inherent in the design and application of louverall and luminous ceilings were discussed, and illustrated by slides, including a number of installations of unusual character and design.

The third and last technical paper was on "Lighting for Television", which was presented by R. L. Zahour, Westinghouse Electric Corporation, Bloomfield, N. J. This paper covered the history and development of both broadcasting studio lighting techniques and camera equipment. Introduction of the image orthicon camera tube Type 5820 (RCA) has eliminated the need for the high lighting levels which were required previously, Mr. Zahour pointed out, as he further described the problems involved in television studio lighting, brightness contrasts, methods of installing the lighting Quicker than it takes to tell it...

With the new Economy
"DE-LAY" Renewable Fuse, you can
replace the "blown" link in less time than it takes
to tell it.

Almost before you can say "Presto-Change-O", you have made these three simple, quick, easy operations:

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CONTRACTOR E. R. Hage (left), Halstad, Minn.; and inspector Louis F. Grosenick, Runestone Electric Association (co-op), Alexandria, Minn., discuss rural wiring problems at St. Paul electrical industry conference.

equipment and the necessary electrical system and controls.

The morning session of the second day of the conference was chairmanned by Alex Hampsey, chairman of the Pittsburgh Section. This session was devoted to "Recent Developments in Light Sources", presented by Willard C. Brown, managing engineer, General Electric Co., Nela Park, and to an "Open Forum Discussion", or "Get It Off Your Chest" session, led by Paul Hildebrand, Pennsylvania Power and Light Co., Bethlehem, Pa. Mr. Brown's presentation of new light source developments was augmented by the display of many currently popular types of fluorescent, mercury vapor, and incandescent light sources, and by illuminated booth demonstrations to show the spectral color properties of new de luxe fluorescent lamps developed to improve color rendition in stores, in the home, and in color inspection problems.

A panel of experts was set up to answer questions submitted by delegates and guests for the Open Forum Discussion. These experts represented light source and lighting fixture manufacturers, consulting illuminating engineers, electric utilities lighting application engineers and the National Bureau of Standards. A large number of questions kept this session going for nearly two hours and covered the entire field of technical lighting data and lighting application problems.

The last session of the conference was devoted to a "My Most Interesting Lighting Job" contest, with Geo. W. Clark of the Capitol Section. Washington, D. C. serving as moderator. A representative from each of the five

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A compact, inexpensive, all-purpose lug for high performance.

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Write for Bulletin T49-2



Sections and Chapters presented the details of an outstanding lighting installation in his own territory, which had won first place in a local contest. These representatives, and the lighting installations presented at the conference were: H. M. White. Baltimore Chapter-Irvin's Department Store, Baltimore, Md.; R. P. Teele, Capitol Section-Traffic Control Center at the Washington National Airport, Washington, D. C.; E. W. Halterman, Eastern Pennsylvania Chapter—Skadium, Greenwood, Pa.; D. M. Hoffman, Philadelphia Section—S. Pagel & Sons Shoe Store, Norristown, Pa.; and John E. Emery, Pittsburgh Section-Graybar Electric Company, offices, warehouse and display rooms, Pittsburgh, Pa. A panel of three judges awarded first place in this contest to D. M. Hoffman of the Philadelphia Section on the S. Pagel & Sons Shoe Store relighting job at Norristown,

A luncheon meeting was held on the opening day of the conference, at which Charles H. Goddard, President of the Illuminating Engineering Society, was guest speaker. President Goddard's subject was the Illuminating Engineering Society, its growth, and a resume of the work the Society is doing.

A banquet was held on the evening of the first day, at which F. M. Pyle, chairman of the Philadelphia Section, presided as toastmaster. Guest speaker for this banquet was Father Thomas Burke of Villanova College, whose subject was "Lighting Education".



HEADLINERS at the recent Adequate Wiring Conference in St. Louis were N. J. MacDonald (left), vice-president, The Thomas & Betts Co., and chairman, National Adequate Wiring Bureau; and contractor Lyle Foster, president, Foster Electric Co., Peoria, III., and chairman of the Peoria Adequate Wiring Committee.



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RAY F. BRAUN, newly appointed executive-secretary of the Minnesota State Board of Electricity, addresses meeting of the Midwest Electrical Council, Inc., at St. Paul, Minnesota.

F.L.A. Elects New Officers

Members of the Fluorescent Lighting Association held their annual meeting in New York recently, at which time they discussed technical and sales problems and progress, and elected new officers for the coming year.

Featured at the meeting was a report on the progress and development of cold cathode fluorescent lighting prepared by Bernard F. Greene, technical consultant to the Association, A highlight of the report was actual experience records from industrial cold cathode installations which have been in service for periods of over ten years. Records of these installations show that cold cathode fluorescent lamp life in excess of 30,000 hours has been obtained, Mr. Greene reported. Similar lamp life experiences have been reported from public school systems throughout the country and from commercial installations.

At this annual meeting, Charles L. Sabatini of Colonial Electric Products. Inc. was elected President of the Association. In accepting the Presidency, Mr. Sabatini expressed a deep appreciation for the work done by retiring President Robert Cutler for the advancement of cold cathode fluorescent lighting. Mr. Sabatini stated that in the few years since it started as a small group, the cold cathode fluorescent lighting industry has developed a world-wide market which can be measured in terms of millions of dollars. It was also pointed out that cold cathode is now the accepted form of fluorescent lighting in many of the countries of the

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- Insulation Tester, 0.200 megohms, 500 volts DC test potential. With exclusive triple-color grading scale.
- Ohmmeter, 0-2000 ohms.
- OAC Voltmeter, 0-150/600 volts.
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Full details in Bulletin 441

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world. Large scale installations have been made throughout Australia. Union of South Africa, India, France, Belgium, Italy, Switzerland, and the newest member of the family of nations, Israel.

Other officers elected to serve for the coming fiscal year were L. C. Marschall of Sola Electric Co., Vice-President; Abner A. Byer of the Cold Cathode Lighting Corp., Second Vice-President; Bruce Todd of the Swedish Iron and Steel Corp., Secretary; and Miles Pennybacker of Voltare Tubes, Inc., Treasurer.

Book Reviews

Electronic Control

Electronic controls, typical of modern industrial practices, are discussed in a practical, nontechnical manner in the revised second edition of "Industrial Electronic Control" written by W. D. Cockrell, industrial engineer for the General Electric Company. Various types of tubes, fundamental circuit components, basic electronic circuits and many more complicated hook-ups are included in the discussion. Wiring diagrams have been redrawn in accordance with ASA symbols and accessory equipment such as clamps, counters, gates and switches has been added to the volume. Of special interest is a discussion of electronics in closed-circuit controllers, feedback amplifiers and servomechanisms.

The book is divided into five sections, covering circuit components. basic circuits, electron tubes, closed-



GLENN ROWELL, electrical engineer, Fire Underwriters Inspection Bureau, Minneapolis, outlines new mended safe practice for electrical installations in hospital operating rooms to Minnesota inspectors.



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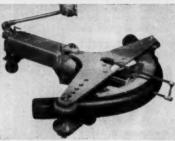
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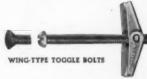
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cycle systems and industrial electronic circuits. The appendix includes nomenclature used in the book, ohmic values of resistance and reactance, standard curves, rectifier wave shapes, photoelectric phenomena and regulating systems.

Priced at \$4.00, the book includes 385 pages measuring 5½ by 8 inches. It is liberally illustrated with both photographs and diagrams. It is published by the McGraw-Hill Book Company, 330 West 42nd St., N. Y. C.

Professional Contracting

"Contracting As A Profession," by F. W. Lord, urges a plan to put the construction industry on a professional level. The author writes from a background of 53 years as founder and head of the Lord Electric Company, Inc., New York.

Elements of the professional method of negotiating between owners and contractors are essentially competitive but not on price alone. The system limits the owner's financial commitment and gives a positive stimulus to integrity, economy, speed and quality.

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To permit such methods of negotiation to proceed on public construction, the author includes a bill to be presented to the Congress. The book is published by Richard R. Smith, New York.

DC Motor Manual

An up-to-date source of practical information is the "Direct Current Motor Manual" written by H. S. Dusenbery, electrical engineer for the Moore Dry Dock Company. Including modern methods of electronic control, the book covers basic theory, construction details, operation procedures and maintenance recommendations. Special chapters deal with regulating exciters and amplidynes. Complete wiring diagrams are included for precision speed control methods and detailed instructions discuss the reconnection of motors to obtain changes in speed and voltage

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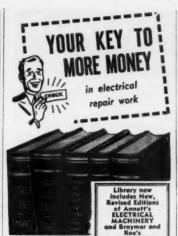


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Rules of the National Electrical Code pertaining to dc operation, complete reference tables and a glossary of technical terms used in the book contribute to the value of the presentation for all men concerned with

The book measures 5½ by 8½ inches, contains 275 pages, is published by the MacMillan Company, 60 Fifth Avenue, New York 11, N. Y., and is priced at \$3.50.

Electric Instruments

Fundamentals of construction and operating principles of all major types of electric instruments are subjects of the revised edition of "Manual of Electric Instruments" prepared by the Meter and Instrument Divisions of the General Electric Company. Prepared primarily for schools, the manual is recommended for those in industry who are only casually acquainted with thermocouples, synchroscopes, frequency meters and electric telemeters.

Priced at \$1.50, the manual includes 150 pages and a full reference index. It is published with the designation GET 1087A by the General Electric Company, Schenectady 5, N. Y.



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Dates Ahead

National Industrial Service Assn.

National Industrial Service Assn.—Annual meeting, Boston, Mass., June 5-7. National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., June 12-16.

New York State Association of Electrical Contractors & Dealers, Inc.—Saranac Inn, Saranac Lake, N. Y., July 1-8. Illuminating Engineering Society—National Technical Conference, Hotel Huntlernational Association of Electrical Inservational Association of Electrical Inservational Association of Electrical Inservational Association of Electrical Inservational Association, Sept. 11-32. Southwestern Section, San Jose, Calif., Sept. 18-20; Eastern Section, Hotel Stater, Buffalo, N. Y., Sept. 25-27; Western Section, Hotel Book Cadillac, Detroit, Mich., Oct. 2-4; and Southern Section, Daytona Beach, Fla, Oct. 16-18.

International Municipal Signal Assn.—35th Annual convention, Hotel Commodore, New York, N. Y., Sept. 18-21.

Canadian Electrical Manufactors associations of Electrical Leagues—Annual Conference, Copicy Plaza Hotel, Boston, Mass., Oct. 11-14.

National Electrical Contractors Association of Hotel Bild.

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National Electrical Contractors Associa-tion—Annual convention, Hotel Bilt-more, Los Angeles, Calif., Oct. 17-20.

National Electrical Manufacturers Asso-ciation—Chalfonte-Haddon, Hall, At-iantic City, N. J., Nov. 13-16.

American Standards Association—Annual Meeting, Waldorf-Astoria Hotel, New York, N. T., Astoria Hotel, New Minter General Meeting, New York, N. Y., Jan. 22-26, 1951.

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This Catalog is an invaluable, up-to-date and handy source of product information on electrical machinery, equipment and sup-plies that is particularly appreciated by the businessman whose time is severely rationed. If PRE-FILED ELECTRICAL CATALOGS is not available for buying reference in your office, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N.Y. There is no charge to qualified users.

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Aluminum Co. of America. 8 American Steel & Wire Co	13	Rome Cable Corp	156 71 142	Industrial Electronics Corp	19 95 148	rrate Mfg. Co m Electric Co., FrankChalmers Mfg. Co9, 14, Steel Equipment, Inc r Co., The Harry	Adam E Allis-Ch All-Stee Alter Co
Auth Electric Co., Inc. 16 Kett Tool Co., The 156 Klein & Sons, Mathias 92 Knight Electrical Products Corp. 21 Bauer & Black, Div. of The Kendall Co. 139 Benjamin Electric Mfg. Co. 93 Biddle Co., James G. 111 Blackhawk Mfg. Co. 121 Briegel Method Tool Co. 36 Brownell Distributors, Inc. 39 Long Co., W. H. 158 Tall Bender, Inc. 158 Tall Bender, Inc. 159 Triangle Conduit & Cable Co., Inc., Herman H. 158 Steckwell Transformer Corp. 159 Stockwell Transformer Corp. 150	20 122 87 ver 151	Slater Electric & Mfg. Co., Inc Snap-on Tools Corp	. 98	Jefferson Electric Co	8 23 41 2 154	ninum Co. of America rican Steel & Wire Co 22, conda Wire & Cable Co 40, leton Electric Co Expansion Bolt Co w-Hart & Hezeman Electric	America Anacone Appleto Arro E:
198 199	11 86 152 155 143	Steel & Tubes Division	. 156 . 92 . 84	Kett Tool Co., The Klein & Sons, Mathias Knight Electrical Products Corp.	16	elite Div. Union Carbide &	Bakelite
Buffalo Forge Co. 112	17	Tal Bender, Inc	. 113	Leviton Mfg. Co	93 111 121 36 39 18 112	in Co. jamin Electric Mfg. Co. lle Co., James G. khawk Mfg. Co. gel Method Tool Co. wnell Distributors, Inc. ant Electric Co., The alo Forge Co.	Benjam Biddle Blackha Briegel Browne Bryant Buffalo
BullDog Electric Products Co. 37 Butow Co., D. L. 156 McGraw-Hill Book Co. 157 McGraw-Hill Pre-Filed Electrical Catalogs 157 Catalogs 1	148	Union Insulating Co	. 155 1	McGraw-Hill Book Co	37 156	Dog Electric Products Co	BullDog Butow
Century Electric Co	23	United States Steel Corp22,	. 83 . 139	Monowatt Incorporated	27 150 118 96 99	ified Ballast Mfrs mpion DeArment Tool Co ulators & Devices Mfg. Corp. ch Co., Inc., S. H icent Ins. Wire & Cable Co	Certified Champi Circulat Couch (Crescen
Day-Brite Lighting, Inc	114 4 89	Weller Mfg Co. Westinghouse Electric Corp. (Lighting Div.) Westinghouse Electric Corp. (Pittsburgh) 25, 28, 76, 77, 85, 88,			150	sert Mfg. Corp	Dossert du Pont
Economy Fuse Mfg. Co. 149 Okonite Co., The	119 157	Wiremold Company, The Wodack Electric Tool Corp.	3, 152 . 154 . 131 . 136	Okonite Co., The	149 133	nomy Fuse Mfg. Co ciency Electric & Mfg. Co	Econon Efficien
Fairbanks Morse & Co. 67, 68, 69, 70 Fasco Industries, Inc. 130 Fitch, Allen & Co. 154 Fullman Mfg. Co. 117 Paine Company 125 Paragon Electric Co. 155 Pass & Seymour, Inc. 80, 109, 124 Peerless Electric Co., The 24 Penn-Union Electric Cop. 29	42		. 125 . 155 9, 124	Paine Company Paragon Electric Co. Pass & Seymour, Inc 80, 109, Peerless Electric Co. The	130 154	co Industries, Inc	Fasco I Fitch,
General Electric Co. (Apparatus Dept.) Second Cover, 7, 33, 34, 129 General Electric Co. (Chemical Dept.) Second Cover, 7, 33, 34, 129 General Electric Co. (Chemical Dept.) Second Cover, 7, 33, 34, 129 EMPLOYMENT EMPLOYMENT		SEARCHLIGHT SECTION (Classified Advertising) EMPLOYMENT	. 90	Pyle-National Co., The	129	eral Electric Co. (Apparatus ept.) Second Cover, 7, 33, 34, eral Electric Co. (Chemical	General Dept. General
Dept.)		EDUCATIONAL Books	. 120	Quadrangle Mfg. Co	102 15 26	laterials Dept.) Fourth Cover, seral Electric Co. (Lamp Dept.) seral Switch Corp	Mate General General
Greenlee Tool Co		Offered EQUIPMENT (Used or Surplus New) For Sale	. 74	Ridge Tool Co	144 82	enlee Tool Co	Greenle Guth
Hazard Insulated Wire Works 78, 152 Roebling's Sons Co., John A 5 Roll-A-Reel Co	. 157		. 155	Roebling's Sons Co., John A Roll-A-Reel Co	152	zard Insulated Wire Works 78,	Hazard

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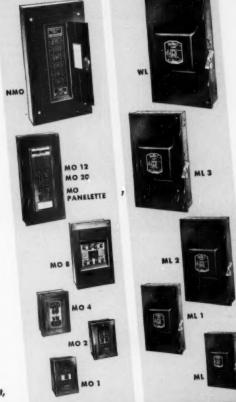
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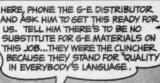


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